JUN 23 1922

In This Issue—*Growth of Specialized Lubrication Service*

MOTOR AGE

Vol. XLI
Number 25

PUBLISHED WEEKLY AT THE MALLERS BUILDING
CHICAGO, JUNE 22, 1922

Thirty-five Cents a Copy
Three Dollars a Year

Dan Morgan's Customers Buy Full Sets

Mr. Car Owner:

If you need a new spark plug, let me suggest a full set of Champions, and keep the rest of your old ones that are still working for your spares. **There goes a satisfied customer.** I just fitted his car with a full set of CHAMPIONS when he thought he needed only one, but he knows now that a single plug could not give "Full Service to his Engine," and that it is real economy to buy a full set, for your engine can only give full service when each cylinder is doing its share. If you are to get the best firing conditions, you must have a full set of plugs of exactly the right design for your engine. Your cost is nothing compared to your saving in gas and oil, as the increased mileage per gallon with a new set will show this saving for you within a few hundred miles driving. After this, you will be making money on your investment.

Mr. Dealer, Dan Morgan's customers appreciate this suggestion. Why not continue the good work to *your* trade?

Champion Spark Plug Co., Toledo, Ohio

Entered as second class matter Sept. 19, 1899, at the post office at Chicago, Ill., under Act of Mar. 3, 1879

SUNBEAM DEALERS—

2 Handsome New Displays for you

Drive in
SAFETY
PREVENT the dangerous glare of sunlight, street lamps and headlights by equipping your car with the A-L-T Sunbeam Visor. Avoid accidents; ride in comfort; dress up your car.
The most useful and practical automobile necessity ever devised. Equipped with "Thoma Process" green or amber quarter-inch ribbed glass—an exclusive feature. Insist upon the Sunbeam—this name-plate on every Visor is your protection.
"GLARING headlights cause accident", is a headline you see in almost every day's news. One such accident may cost you the price of a dozen Sunbeam Visors—perhaps a personal injury or a life. The Sunbeam Visor is the cheapest accident insurance you can buy—have one put on your car today.
A-L-T SUNBEAM VISOR
THOMA & SON INC
$16.00
WEST OF THE ROCKIES $18.00

This practical display stand, finished in rich mahogany stain, furnished with every "Star Account" order for 6 or more visors—an exclusive Sunbeam feature.

Above: Striking 3-color wall hanger 21"x28", tinned top and bottom and shipped to you in a tube. It's a beauty! How many?

At Left: A 3-color window streamer, 6"x31", that will flash a message to the hundreds of car owners that pass your place of business. How many?

THESE sales helps are typical of the many ways in which we help you sell the Sunbeam Visor—at our expense. Write for Co-operative Sales Plan and our liberal dealer proposition.

Sunbeam Visor Manufactured by

THOMA & SON-INC.
Everything in Glass for the Automobile

Fairfield, Iowa

MOTOR AGE

Published Every Thursday by
THE CLASS JOURNAL COMPANY
MALLERS BUILDING
59 East Madison Street, CHICAGO

Vol. XLI Chicago, June 22, 1922 No. 25

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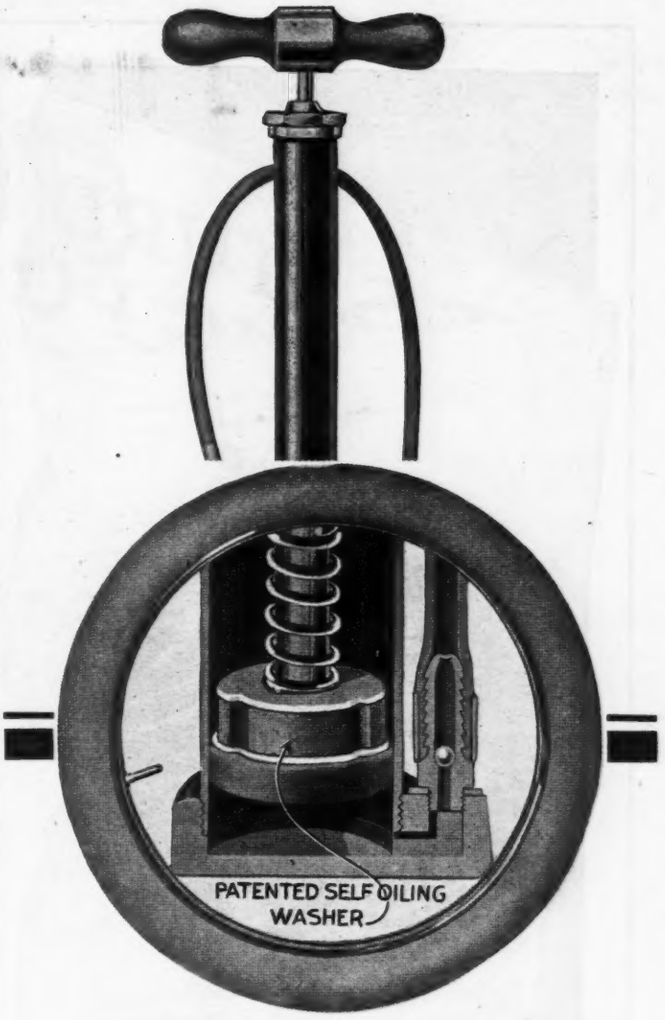
SUBSCRIPTION RATES

United States, Mexico and U. S. Possessions	$ 3.00 per year
Canada	5.00 per year
All Other Countries in Postal Union	6.00 per year
Single Copies	35 cents

Subscriptions accepted only from the Automotive Trade

Entered as Second Class Matter Sept. 19, 1899, at the Post Office at Chicago, Ill., under Act of March 6, 1879.



THE PUMP THAT SELLS ITSELF

Dealers and car owners, who have investigated the MONROE Self-Oiling Tire Pump, are MONROE enthusiasts to a man. They have found that the *patented* MONROE Self-Oiling Washer puts an end to air leakage, prevents "drying out" and keeps the pump ready for *instant* service—not for months, but for years.

It requires little effort to sell this dependable, low-priced pump—it practically sells itself. And every sale brings a *quick, substantial* profit. You'll want complete particulars. Send for them at once.

Monroe Auto Equipment Manufacturing Co.
Monroe, Michigan

Sales Representative to Jobbers only:
The Fulton Company, Milwaukee, Wis.

MONROE
Self-Oiling
TIRE PUMP

SATURD
July 1 1922
THE SATURDAY EVENIN
Timer-Wise!
—No More Roadside Tin
SOARING smoothly over hills, pulling steadily th
sand and mud, whirling blithely past the "roadsi
your Ford leaves engine trouble far behind—if you
timer-wise.
Under the hood, dependable as the engine itself,
Milwaukee Timer—so every explosion is full-powered, cle
snappy. No wonder your Ford pulls harder, starts ea
stays freer of carbon than ever before.
You, and a million other timer-wise Ford owners, kn
that your Milwaukee Timer is the best two-dollars'-wo
you ever bought for your car.
MILWAUKEE MOTOR PRODUCTS, Inc.
MILWAUKEE, WISCONSIN
LWAUKEE TIMER for FORDS
$2.00 at auto supply and hardware store and garage

See this Full-Page in the Post, July 1st.

More Help for

The Timer-Wise Dealer

He specializes—a Timer-Wise Dealer does—on timers, as he does on tires, spark plugs, and other classes of goods.

He features just one timer (he doesn't believe in competing with himself)—a timer that his trade knows; one that's liberally advertised, a standard value at a standard price; one that he doesn't have to "explain" to a customer.

Nine times out of ten, his timer is the ***Milwaukee***—and he has a real business built on it. Quick turnovers—never much money tied up!

If YOU are Timer-Wise, you benefit by Milwaukee Timer advertising. We're running a full-page in the July 1st Saturday Evening Post. Display it in your window—with a Display Stand and perhaps a stack of Milwaukee Timer cartons. "Ask 'em to Buy".

Remember, a lot of Posts come into your town. Make 'em work for you!

MILWAUKEE MOTOR PRODUCTS, INC.
MILWAUKEE WISCONSIN

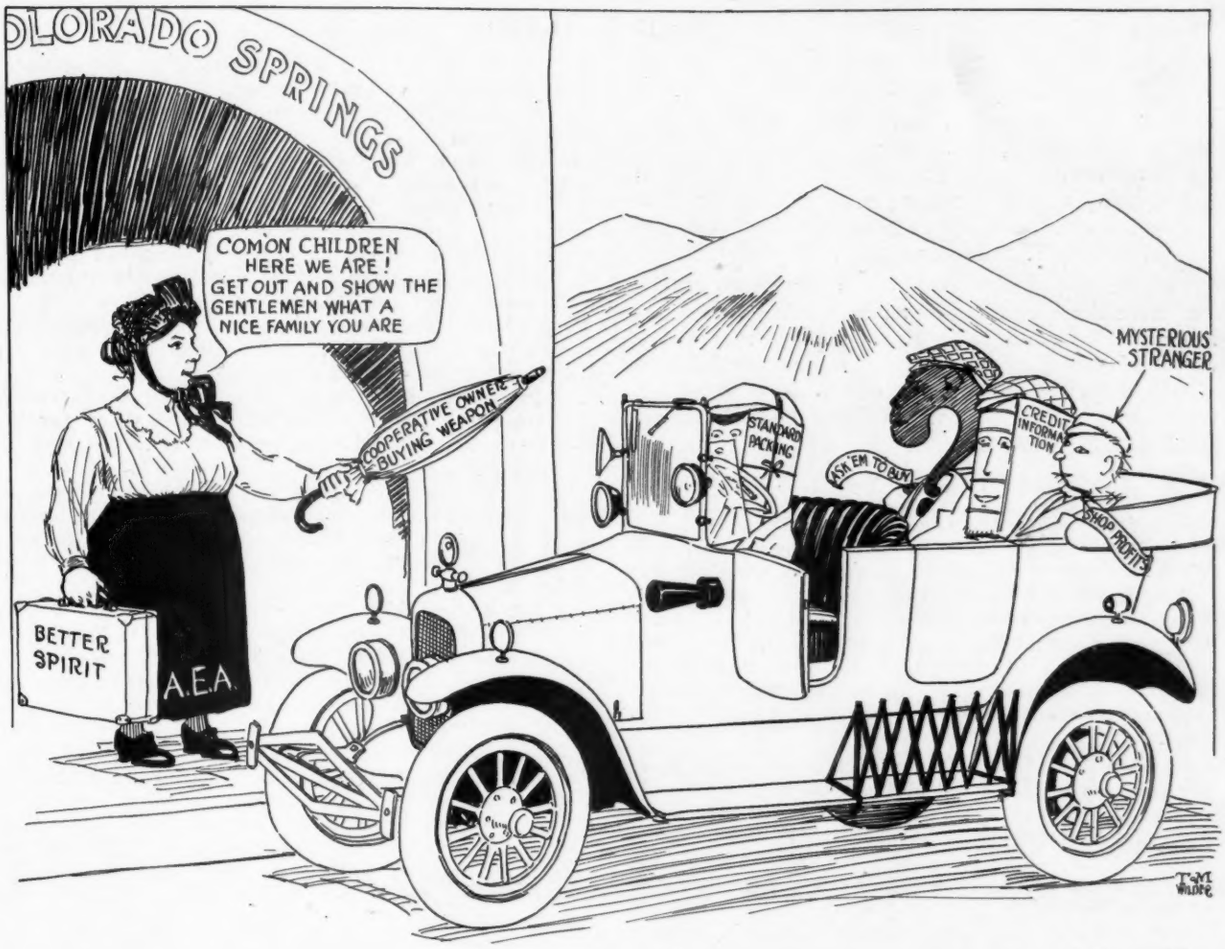
Retail Price $2.00

MILWAUKEE TIMER *for* FORDS

Famous wherever Fords are driven. Over 1,000,000 in use. Timer-Wise dealers stock no other.

Vol. XLI, No. 25 Chicago, June 22, 1922 $3 Per Year

MOTOR AGE



With Eyes to the Future

THE Automotive Equipment Association is in session this week at Colorado Springs. There will be much golf, much planning of vacation trips in the great and picturesque west and much business talk there.

The actual happenings at a convention are not as important as the trend of thought as to the future and the growth of the idea of organization work and what it means. Most organizations originally start with the view that the members only should benefit. Slowly but surely there comes the greater idea that the entire industry should benefit, with only special favors and information for the members.

The A. E. A. has creditable developments to its record. In the above drawing are illustrated some of them. There is no question as to the benefit to the entire industry of the fight against the cooperative idea of merchandising as the automotive industry knows it. Credit information is always helpful to every legitimate dealer in the industry, because it weeds out the thieves and illegitimate dealers.

HIGHER standards of packing have been a benefit to every one down to the car owner who buys the spare articles and wants them to come in a decent, protective package. The benefit of this movement to dealers who like to keep clean stocks cannot be measured.

"Ask 'Em to Buy" needs no word of comment. It was a primary but much needed education. "Shop Profits" was the newcomer this year. Every "Ask 'Em to Buy" enthusiast was awaiting this movement with interest.

What next? The future must bring something bigger and better.

After the Sale of the Car, *What?*

Clear Understanding of Service Policy by Customer Will Prevent Much Grief Later — Loosely Worded Guarantees Lead Owner to Expect Too Much—A Few Important Instructions

By B. M. IKERT

THERE are many dealers successfully selling maintenance on motor cars today because they sell it understandingly.

They have learned from the past that the selling of cars is one thing and that selling maintenance on these cars is quite another. They are organized to sell cars. Likewise they are organized to sell maintenance.

Only where the dealer has had a thorough understanding with the customer to whom he has sold a car, will he profit on maintenance and repairs incident to that car. The 90-day guarantee means something, of course, but the customer should not be lead to believe that this means the dealer will make all repairs on the car should these be necessary during the 90-day period.

Understanding with Customers

The other day we heard a dealer who made a dangerous remark to a new customer about to buy one of his cars. He said, "We'll take care of the car for you for six months."

Now, just what did he mean? He meant, probably, that his organization would make adjustments on the valves, carbureter, and similar operations, for six months. But what was there in the statement to prevent the customer thinking the dealer would replace the flywheel starter gear free of charge, should the teeth become stripped by carelessness in starting the engine?

After a customer has had delivered to him a new car there starts a critical period for the dealer, unless he has properly fortified himself and has had a real understanding with the customer. And it is far better to have things written on a sheet of paper, rather than a verbal agreement. There must be records to show what has been done and what is to be expected in the future.

No dealer should let a car go out of his place and say to a customer, "There she is, all ready for you. We've gone over her, but if anything comes up, run her in and we'll fix it." A dealer who talks that way is courting trouble about as boldly as he can.

True, no one can foretell what is going to happen in a new car, but it is within the power of every dealer to take the necessary precautions to have the car right at the time of delivery and also to have a correct understanding with the customer as to just when he is to drive in for adjustments, what he is to pay for and what work will be done free of charge, and for how long a period.

"Through with 'Service' Stations"

When a man has bought a new car, he is usually pretty keen about it. He takes care in keeping the body polished, in having proper pressure in the tires, and other precautions he understands. He is receptive to anything that will help him get the best service out of his purchase. It is the period when a dealer either makes a permanent customer out of him or loses him altogether.

It is a trying period for the dealer because the customer is apt to want a lot of things for nothing and probably will get what he wants, if the dealer is not on the alert.

Recently a man told us he was through with "service" stations so far as work on his car was concerned. He would try the work himself, he said. He was disgusted with Blank's "service" and it was his opinion that to get anything done properly meant working on the car yourself. But let him tell his own story.

"I bought a Blank car some five or six weeks ago and they told me to bring the car in in a short time so they could adjust valves, carbureter, and give it a general tuning up.

"The other day I left the car with the dealer after having made mention of the things that ought to be looked after. Some of the valves were noisy and, among other things, I noticed the hood would shift back and forth when the car was traveling over rough roads.

"A grease cup had been lost from the left rear spring where the latter fastens to the rear axle. Then there was the left rear door which needed some attention, as it would not always stay closed.

"Last but not least, there was a rather annoying squeak somewhere around the point where the right front fender joins the frame of the car. These were the several things which I thought needed the immediate attention of the service department.

"I left the car there for a day and was told I could get it in the morning. They said the jobs were of a minor nature and so the car would be ready for me.

"In the morning I went there. I asked for my car. Oh yes, I had driven in yesterday, they remembered, for some 'policy adjustments,' whatever that meant. They were sorry and all that, but unfortunately some unexpected jobs had come into the house during the day and they had to put all the men on them. Consequently they could not get all the work done on my car, but wouldn't I come back in the afternoon—the car would then be ready for me. 'Of course,' they said, 'we can rush it out for you while you're here, but we would rather take a little more time and make sure everything is done right.'

A Telephone Call

"There was nothing for me to do but leave the car until later in the day. But it seems to me they could easily have called me by telephone and informed me of the sudden rush of work so I would not have made an unnecessary trip.

"Well, anyway, in the afternoon I came back as per instructions. The car was parked outside at the curb and, to use their own words, 'She was all ready to drive away, had had a good tuning up.'

"The work, supposedly done, cost me nothing, excepting that I had to pay a small sum for the fresh oil which had been put into the engine. That charge was perfectly legitimate. I paid it and drove away.

"On my way home I struck a little stretch of rough road and as I did, I noticed the hood shifting around much the same as it had done before. This made me wonder about the rest of the work which they were supposed to have done. I stopped for an investigation.

"Just as I slowed down, the left rear door swung open, just as it always had done. I examined the door, and so far as I could see, nothing had been done to fix it. From the little I know about these things, it seems to me all that was necessary was to take out two screws in the catch and file it down a bit so the latch would slip all the way in.

"I remembered the grease cup on the rear spring. There was some kind of a cup there, but it didn't look like the one which had been there before. I inspected it more closely and found it to be an oil cup. Well, maybe oil works just as well as grease at this point, but it seems to me as long as the maker of the car has specified a grease cup, that's what ought to have been there.

"I will give them credit for having made the engine more quiet by adjusting the valves, and so far as the engine is concerned, it evidently had been given a good tuning up.

A Good Cause for Anger

"Now, what angers me is to think that I had been lead to believe all the time that the little things I had asked them to do were attended to. I didn't want a lot of free service, but I had left my car there on their own invitation. Certainly the door of a car a man buys ought to stay closed and the hood be made to stay in place. And, doesn't it seem a nice state of affairs when a service department takes it into its own hands to put an oil cup where a grease cup ought to go?"

And so this man went on. He was one of the many persons who bought a new car and who had been told to bring it in any time after he had driven it a little and it would be given an inspection, tuning up and minor repairs made free of charge.

The whole thing means that somewhere in the organization which sold this man the Blank car, there was something lacking. The first mistake was made in not having made a complete inspection of the car before it was turned over to the customer.

In the better operated dealer establishments, new cars are inspected closely by checking over various items from a selected list. Thus a door which does not open and close properly will be found because, before the car is pronounced O. K. for customer, it must have passed the inspector, who sees that there is a check mark back of every item on the new car inspection report.

A mistake was made in placing the car at the curb before the car had been tested and checked by someone to make sure the jobs had been properly executed. In fact, the customer should have had a duplicate copy of the repair order, which order should have listed all the items to be attended to. In other words, when the owner came in, a competent man should have listened to his troubles. Then a repair order should have been made out, preferably in triplicate, one copy for the shop, another for the office and the third for the owner.

Before the car was pronounced O. K., an inspector should have taken the repair order and checked the valve adjustment and engine tuning. Then the door, the squeak in the fender and any other thing listed. If all have been attended to, there is ample assurance that the customer will have no grounds for a kick.

Personal Contact Needed

But if he gets the treatment described here, he feels that he has been "stung" so far as "service" is concerned. The dealer's maintenance station might be a large place and all that, but the customer who has bought a new car and is disappointed the first time he comes into the maintenance department is not apt to be a good customer later on.

Only the other day, a car owner made this statement: "I used to live in a small town where I knew most of the people and, among others, I knew pretty well the automobile dealer who sold me my car. I used to drive into his place and say, 'Tom, will you look at the distributer points,' or carbureter adjustment, whatever it might have been, and he or his men would go after it. I had personal contact with the man who cared to see that I got satisfaction out of my car.

A Condition of Every Day

"But now it's different. Here, in this big city, I leave my car at the maintenance establishment, where they ought to know everything there is to know about the car and ought to have all the facilities for taking care of customers. Yet when I come for the car and drive it away I find many things left undone. Or, what has been done is not done right. So now I have run across two young fellows who are running a shop near my home and who are well acquainted with the make of car I drive. They seem to know their business and I can work in closer contact with them than I can with the dealer's place of business."

This is a condition which arises most every day. It is a condition which has made possible the flourishing of the so-called "alley repairman." And he will flourish just as long as the dealer who should be selling first class maintenance on the vehicle he sells does not seriously take to heart the critical period coming immediately after the new car has been delivered to the customer. The same applies to the independent maintenance establishment which has grown big and then forgets the food on which it flourished.

How about the man who says, "We'll take care of the car for you for six months"? He is courting a lot of trouble, unless he knows and the customer knows, exactly what he means. The 90-day guarantee is pretty well understood by most dealers and people who have bought cars. They know that should a part break during that time and inspection shows clearly that the fault lies in the part or manufacture of the car, that part will be replaced free of charge.

Suppose a new car owner comes in with a smashed fender and expects the dealer to replace it, because he says the steering gear works so stiff that he could not avoid hitting some object and crushing the fender. He probably will say that the service station should not have sent the car out with the gear working so stiffly. Maybe the car did not have an inspection of the right kind, and after the gear is freed, steering is easier. Still, the dealer feels he is not responsible for the man crushing the fender.

Avoiding Little Squabbles

On the other hand, the cutsomer is trying to get out of paying for straightening the fender. In the long run, the dealer will probably roll out the dents without cost, charging the work to "policy."

All of which could have been avoided had the car been inspected and adjusted according to a chart.

When the new car is delivered, the dealer should know that that car is in perfect shape to drive. The customer should see the new car inspection report and realize that he is being handed a car that mechanically is as perfect as it can be made.

Then if he crushes a fender or breaks something through carelessness he comes prepared to stand the loss.

Be careful of the statement, "We'll take care of the car for you for six months." Better have the car right to begin with and then charge for your service afterward.

Getting the Customer Started Right

AFTER a new car has been delivered to a customer in which all necessary adjustments have been properly made, tool equipment checked, chassis completely lubricated, and the customer has been sold understanding the company's maintenance policy, he, as well as the dealer, ought not have any serious trouble in the future on the transaction, unless one important point has been overlooked. And that is the few general instructions which must be given the new customer before he ventures very far with his car.

A new car stopped on a country road the other day and when the driver attempted to restart the engine, there was no response, although everything had been all right a few minutes before. The driver was as "green" around engines as he could be. A passing motorist stopped to give aid. He, being an old timer, readily appreciated that the drive on the starting motor was stuck and showed the new driver how simple it was to put the gear lever in one of the speeds and roll the car backward slightly to release the stuck gears. It is simple, of course, when you know how.

Before the customer goes away with the new car tell him about keeping the battery terminals clean, to change oil in the engine regularly, keep the tires up, pull off a spark plug wire and let him listen to a cylinder that misses. Go over the instruction book with him and underscore with a pencil the important things you think he ought to know. It may save him calling a garage man. It is highly important to get the new customer started right with his new car.

Call his attention to the sticker on the windshield which says the car must not be driven over 25 m.p.h. for the first 500 or 1,000 miles as the case may be.

Lubrication Service Growing Into a Profitable Business or Sideline

With Proper Equipment and Advertising Dealers and Garagemen Can Work Up a Substantial Branch of Income—Specialists In This Service Opening Many Types of Establishments

By FRANK BALLARD

GROWING from a despised duty to a profitable and necessary business of no mean financial investment and turnover in a few years is the interesting history of the oiling and greasing branch of the automotive industry. The specialist has stolen a march on the majority of dealers and garagemen and has built up a thriving trade by intelligently selling a service that in former years had, to a great extent, gone begging. In all cases the labor is charged on a flat rate basis.

Not all dealers, however, were blind to its profit possibilities, and some have kept well abreast of the best plans evolved to merchandise this service on a systematic and properly equipped basis. This specialized branch is producing a sizeable revenue for these men who, having seen this trend in lubrication service because of the convenience, economy and saving in time it afforded the motorist, have gone about setting up the necessary rack and surroundings and advertising it with signs and other selling media.

With the rapid growth and profit attractions of this business on a small investment, many men of doubtful business ability are prone to rush in heedless of the fact that only on a permanent and satisfaction rendering basis can they succeed.

Because of the nature of this work, many operations can be slighted or left entirely undone without the customer finding it out for many miles. Here lies the chance for conscientious workers and business men in this field. After the car owner has been "gyped" a few times, he is wary in all his business dealings and hesitant in placing his confidence. Repeat business is always most profitable. It is up to the earnest and business-like workers to gain and foster this confidence and build a permanent and paying business.

Good-Will Building

In connection with this service, many opportunities will arise to gain the confidence of the customer and build goodwill that will assure the future of the particular business taking advantage of these little opportunities. One of them is the matter of calling the customer's attention to worn or loose parts, which if left unattended would later, perhaps, result in an accident or costly repair bill. It is one of the little things that show the motorist you have his interests at heart and are trying to serve him in every way possible, not alone for immediate gain, but because you treasure his future business. More of this attitude of willing service is necessary if the maintenance business is to gain the place in the owner's confidence that it must have.

Another factor, which at first glance may seem of small moment but which has a far reaching influence on the repeat business, is the interest in the oiling and greasing operation exhibited by drivers while waiting for their cars. To many the chassis and underparts are a mysterious conglomeration of darkness and dirt. On the rack, where the owner can see the underparts of the car without discomfort, a new understanding is given to them of the vital wearing parts that need attention, and after the first job it should be easy to get this business regularly. Invite the driver to "take a look."

Periodical Lubrication Service

In sections of the country having variable seasons, with the approach of temperate weather, crude wooden structures are making their appearance on vacant lots bordering on heavy motor traffic. These are usually open affairs and at the mercy of the weather. They, however, have one distinct advantage in that they are very conspicuous, and a few signs judiciously placed serve to advertise them well, and as a result they are kept busy.

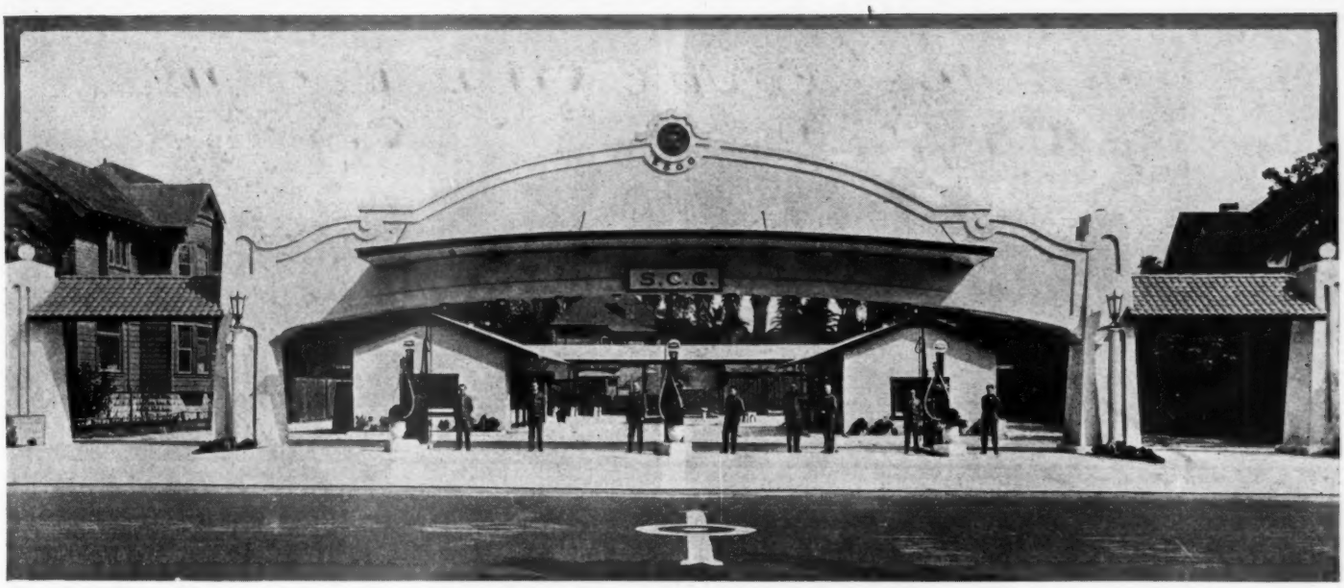
Dealers doing a storage business, in addition to the sales and maintenance of their own cars, can inaugurate a period-

Chart of Oiling and Greasing Points on Average Car

1	Starting Crank	
2	Front Springs	
	" "	
3	Rear Springs	
	" "	
4	Shock Absorbers—Front	
5	" " Rear	
6	Front Wheel Hubs	
7	Rear " "	
8	King Bolts	
9	" Bolt Housing	
10	Tie Rod Bolts	
11	Drag Link	
12	Speedometer Swivel Joint	
13	Steering Gear Shaft	
14	Brake Shaft	
15	Brake Equalizer	
16	Pilot Bearing	
17	Universal Joints—Front	
18	" " Rear	
19	Tork Arm—Front	
20	" " Rear	
21	Radius Rods—Front	
22	" " Rear	
23	Jack Shaft Bearing	
24	Brake Cam Shaft—Front	
25	" " " Rear	
26	Pinion Shaft	
27	Rear Spring Seats	
28	Brake Drums	
29	Rear Axle Housing	
30	Starter Siding Gear	

31	Transmission Hanger	
32	Clutch Shaft	
33	Clutch Release Fork Pin Shaft	
34	" " Bearing Retainer	
35	" Throw Out Collar	
36	" Case	
37	" and Brake Pedals	
38	Emergency Brake Lever	
39	Gear Shift Lever	
40	" " Shaft	
41	Starter Shaft	
42	Radiator Support	
43	Motor Support	
44	Fan Bearing	
45	Water Pump	
46	Rocker Arms	
47	Distributor Shaft	
48	Steering Gear Housing	
49	Governer Shaft	

Charts like the above could be checked as the work proceeds and handed to the owner when completed. There is more work to be done than the owner realizes and printed evidence like this serves to justify the charge

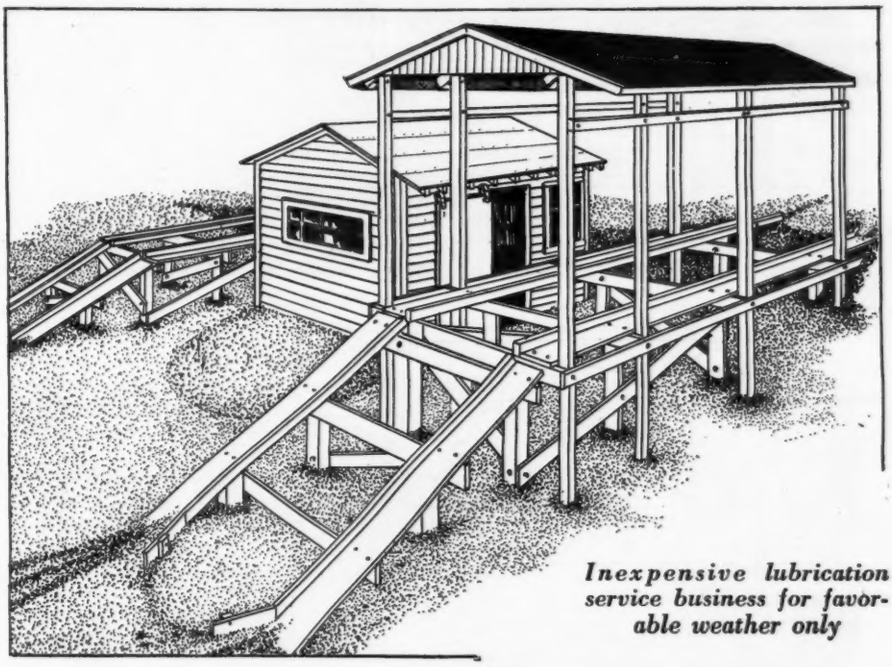


Oiling and greasing station for all year operation in temperate climate

Three Types of Exclusive Oiling and Greasing Facilities

To meet the varying local conditions, different designs of buildings and layouts have been developed. The three shown on this page represent average types. One for temperate climates operates all year without being enclosed. Another is inexpensively constructed and does business only during favorable weather and closes in the winter. The third being enclosed in a permanent building operates anywhere, all year through

ical lubrication service based on a flat rate for a group operation to be done every few hundred miles. The attendant takes a speedometer reading when the first service is performed and therafter checks up the speedometer reading on each car every few days, and when a predetermined number of miles has been run the service is repeated without further orders from the customer. This assures the car owner of proper lubrication without his being annoyed and supplies a steady source of maintenance revenue to the dealer.

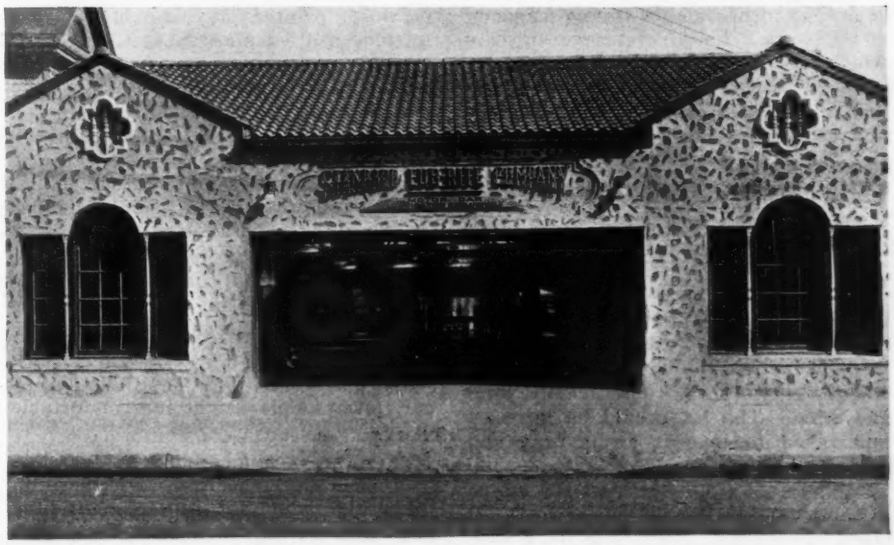


Inexpensive lubrication service business for favorable weather only

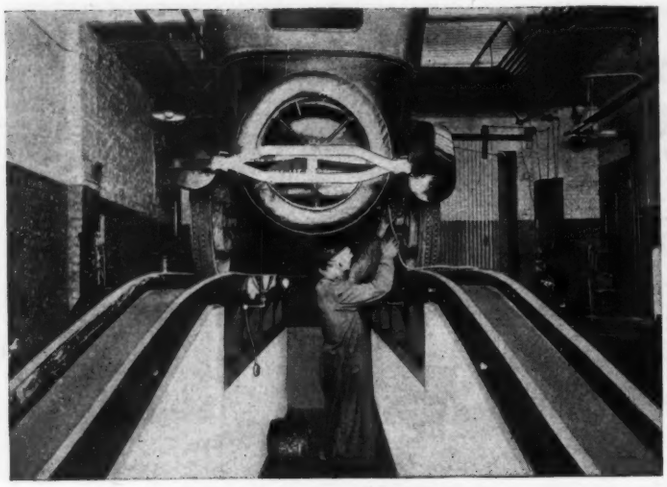
The Various Types of Buildings

The lubrication service as a specialized business is executed in varying degrees of dignity and equipment. On these pages are illustrated different types of establishments. One type is that located in a temperate climate, and while virtually an outdoor affair, represents a substantial investment. It has an elaborate concrete arched front of attractive design, with driveways on either side, and the entire area is cement or gravel. Two small stucco buildings are used to stock and sell accessories and supplies. In the rear are the service racks, which are roofed to afford protection from the sun and rain.

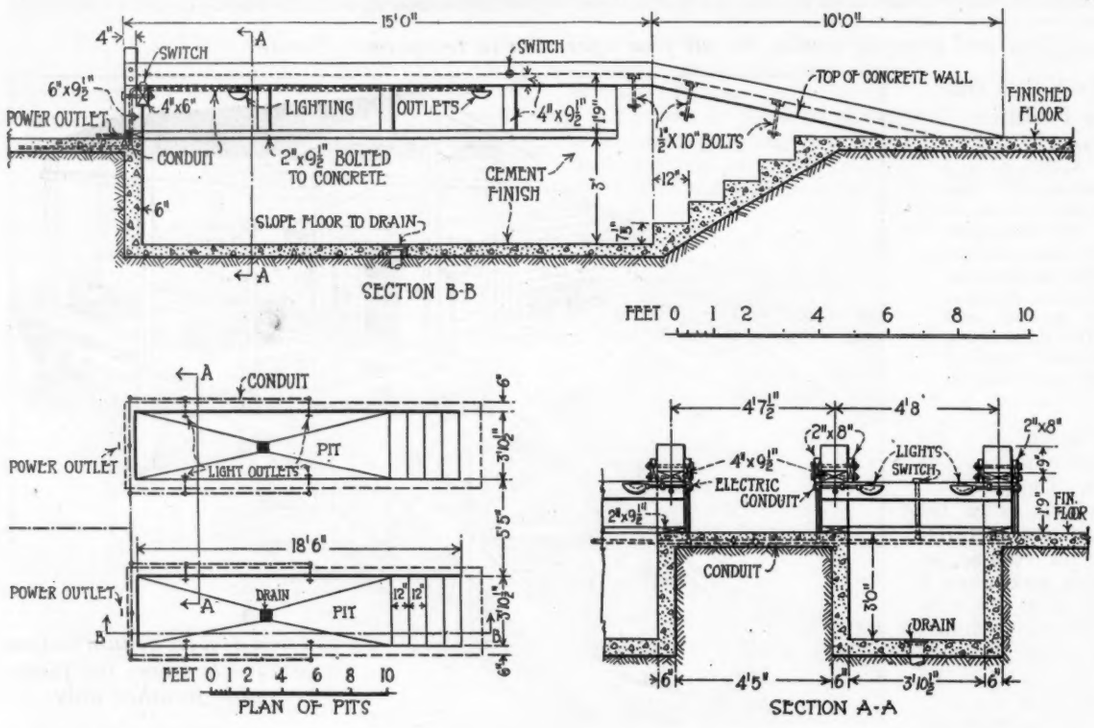
The lower picture illustrates an attractive building devoted exclusively to the lubrication of motor cars, as attested by the sign on its face. This building houses racks to accommodate four cars



A modern, enclosed oiling and greasing station for operation in any weather



Oiling and greasing racks and pit constructed after the plan shown below



PLANS AND SPECIFICATIONS OF PIT AND RACK

Contractor to do all excavating necessary and remove all dirt and surplus material from the premises.

Concrete work to include walls, floor and steps of pit as shown and all patching of the floor around the pit. The rough concrete shall be composed of one part portland cement, two and one half parts sand and four and one half parts gravel. The finish shall consist of one part portland cement and two parts sand, troweled to an even smooth surface laid on top of the rough surface before same has set.

All bolts to be imbedded in concrete before same is set.

All lumber to be pine, S-4-S of dimensions shown and bolted or screwed together so that same can be taken apart and reassembled.

Install four 40-watt outlets for each pit with swivel socket (Benjamin 99) and half reflectors as shown, also one 150-watt outlet at (c) to be controlled by 2-3w switches located at (a) and (b) fees for light and power outlets to be laid in finished floor.

All woodwork to be given three coats of gray paint. Electric conduits to be painted black.

at once, and has ample storage capacity on the sides for the storage of cars which have been lubricated and are being held till the owners call. An investment like this can be operated in any section of the country, winter and summer.

Combined Pit and Rack

The least expensive arrangement of all is the wooden rack erected on a rented piece of ground, together with a small shack to house tools and supplies. In the type illustrated here a roof has been erected over one of the racks and has curtains which can be pulled down to shield the workers from the sun, rain and wind. The lot should be graveled and raked to present an inviting and business-like appearance.

A plan for a combined rack and pit, as prepared by the Bassick Mfg. Co., is another illustration. This calls for a substantial cement pit with a sturdy rack of wood, painted gray and black. The pit idea has some advantages, in that it is not necessary to elevate the car to a great height, which facilitates oiling work on the engine without climbing on the rack. A very desirable feature of the cement pit is the drain for carrying off waste crankcase oil and drippings. Where this waste oil is merely dumped on the ground and allowed to soak in, it proves to be objectionable. Electric bulbs are used to furnish light. The structure is 1 ft. 9 in. above the surface and 3 ft. deep in the pit, giving 4 ft. 9 in. elevation from the floor of the pit, which together with the road clearance of the car, gives ample height for comfortable work.

There are a number of ingenious and well-made steel and iron work racks on the market which incorporate many time and labor-saving facilities. One with which we are familiar has a pair of revolving drums on which the rear wheels ride, permitting the duplication of running conditions on the road. For oiling and greasing service and trouble shooting, the manufactured racks should prove of valuable assistance.

Computing Charges

Charges for the lubricating service should, of course, be flat rates. Cars vary to some extent in the number of lubricating points, and prices must be compiled accordingly. The number of oiling and greasing operations to completely service the average car will be in the neighborhood of 45. Changing oil in the crankcase is usually charged at the cost of the new oil put in, and the rear axle and transmission are charged per pound of grease used.

The labor charge for a complete job on a Ford is usually $2, on Chevrolet $3 and larger cars $4 and up. A typical

bill for a complete job on a Dodge is printed below:

Labor, all greasing points and oiling springs	$4.00
Differential filled, 3 lbs., at $.25	.75
Transmission filled, 4 lbs., at $.25	1.00
Crankcase drained and filled, 6 qts., at $.30	1.80
	$7.55

An up-to-date and well managed oiling and greasing business in Chicago has instruction books on almost every car to refer to whenever doubt arises as to certain points requiring attention. For the springs the company uses a penetrating oil which is applied after the springs have been thoroughly cleaned of caked grease and mud with a stiff wire brush. After applying the penetrating oil, which is thin bodied and quick to evaporate, a coating of heavier oil is given the springs. It is claimed that this acts as protective coating and prevents dissipation of the penetrating oil.

Dealer's Group Operation

A plan for securing the continued business of customers would be to sell lubricating service books holding about 12 coupons, entitling the owner to that many complete services, the 12 to be sold at a slight discount from the total charge for 12 ordinary visits.

Along the lines of this article the Lord Motor Co., Los Angeles, inaugurated a monthly inspection and oiling service that has been worked up to a very profitable sideline for the maintenance department. Owners who will agree to purchase this service for a period of six months or longer are charged a flat rate of $5 per month. The service includes oiling and greasing of all shackle bolts, spring leaves, steering knuckle pins and connections, universal joints, oil fans; filling of transmission and rear axle; filling of battery with water; tightening all outside nuts and bolts and removal of annoying squeaks.

Postal cards are sent out by the superintendent of the maintenance department to the owners who have signed up for this service, reminding them each month to bring in their cars.

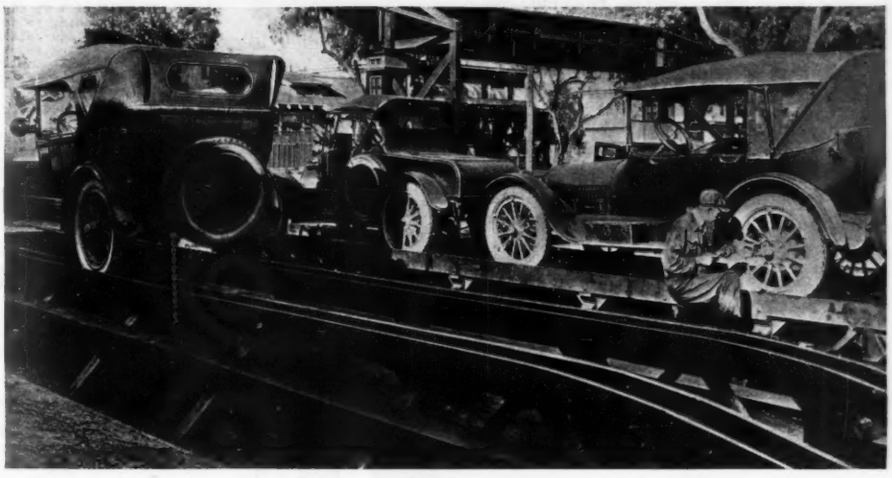
The Jackson Park Lubricating Station, Chicago, maintains a system of cards whereby they keep themselves and car owners posted as to when the car needs lubrication. On this card is the name and address of the owner, make of car, when last attended to and service performed.

Lubrication Service Salesmen

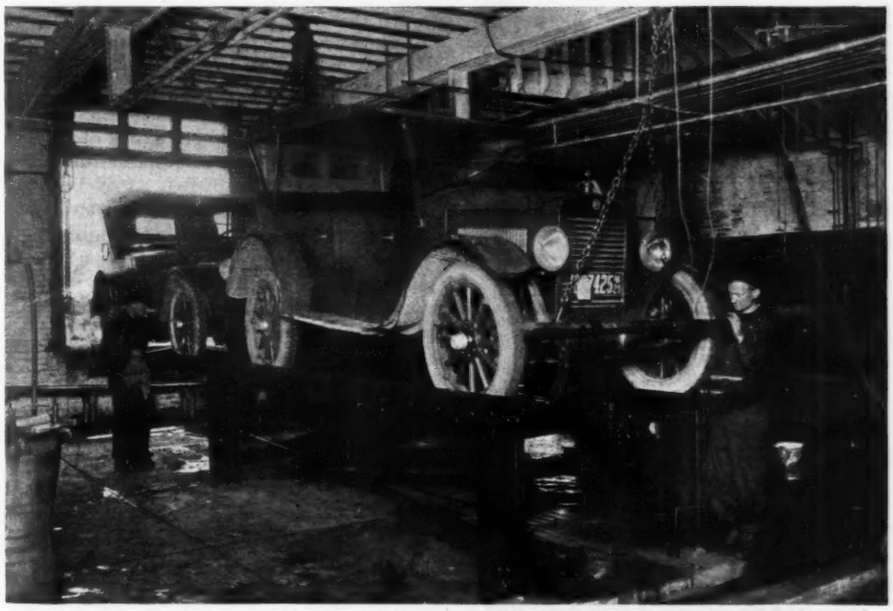
At the end of a certain period, the owner is advised by postal card to drive around and see if the car is again in need of attention. If the car is not brought in at the end of two or three days, a salesman calls upon the owner and gives him exact information as to the condition of his car.

No attempt is made to sell a man anything that is not needed and this service has proven a success. Most of the car owners in the community have learned to leave their car lubrication worries to this company.

A feature of the station is the orderliness and cleanliness of everything. All of the men are uniformed in white jumpers and overalls which are supplied clean to them every second day. Two porters are employed to keep the floors clear of all grease and oil and cloths, while two others work on the cars which have been finished and are ready to be turned over to the owners.



These are examples of a common lubrication service layout. The signs are attractive, easy to read, and it is easy for the passing car drivers to take advantage of this service without delay.



Lubrication of the car springs is greatly facilitated by taking the weight off the springs with the aid of a chain hoist. This allows the spring leaves to be readily separated for the introduction of the lubricant. This method is especially effective in cases of where the springs have become literally frozen together

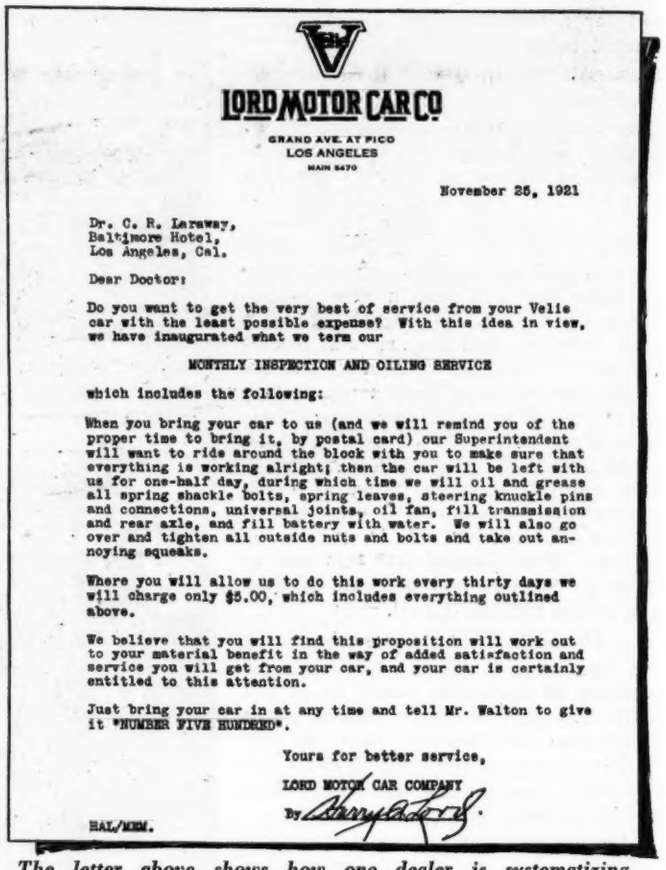
The outer appearance of the building is of California stucco design and the inside is kept spotlessly white. For people desiring quick service, there is a waiting room, away from the noises of the shop and street where books and magazines are supplied and a radio outfit kept.

Two ideas that have been put into practice by two enterprising business men in Texas are worthy of adoption by others engaged in selling lubrication service. One is the catch advertising novelty of offering one dollar for every grease cup overlooked. It implies a guarantee of thorough work and gives a lasting and favorable impression. The other idea is a covered observation stand next to the rack from which the customer may view the progress of the work on his car with comfort.

Reclaiming Diluted Crankcase Oil

The matter of proper lubrication is one of vital importance, especially as regards engine crankcase oil. Because of the difficulty of totally vaporizing the low grade gasoline now being produced, much raw fuel is being passed by the pistons into the crankcase and diluting the oil. This is more serious than the layman in the industry thinks. Oil so diluted suffers a serious decrease in lubricating value, and excessive wear and scored cylinders are the result.

Manufacturers have seen the dire consequences of crankcase dilution, and a perusal of their instruction books drives home the fact that they are combating it with all the information and advice they can give. Whereas in past years the average instruction book advised completely changing the oil every 3,000 miles and in later years narrowed down to 2,000 miles, it is now emphatically stated that it should be done every 1,000, or better still, every 600 miles if excessive wear is to be avoided. Some manufacturers, to emphasize the importance of this, have gone so far as to print this warning at the bottom of every page in the instruction book, so that the owner would surely read it several times and be impressed.



LORD MOTOR CAR CO
GRAND AVE. AT PICO
LOS ANGELES
MAIN 8470

November 25, 1921

Dr. C. R. Laraway,
Baltimore Hotel,
Los Angeles, Cal.

Dear Doctor:

Do you want to get the very best of service from your Velie car with the least possible expense? With this idea in view, we have inaugurated what we term our

MONTHLY INSPECTION AND OILING SERVICE

which includes the following:

When you bring your car to us (and we will remind you of the proper time to bring it, by postal card) our Superintendent will want to ride around the block with you to make sure that everything is working alright; then the car will be left with us for one-half day, during which time we will oil and grease all spring shackle bolts, spring leaves, steering knuckle pins and connections, universal joints, oil fan, fill transmission and rear axle, and fill battery with water. We will also go over and tighten all outside nuts and bolts and take out annoying squeaks.

Where you will allow us to do this work every thirty days we will charge only $5.00, which includes everything outlined above.

We believe that you will find this proposition will work out to your material benefit in the way of added satisfaction and service you will get from your car, and your car is certainly entitled to this attention.

Just bring your car in at any time and tell Mr. Walton to give it "NUMBER FIVE HUNDRED".

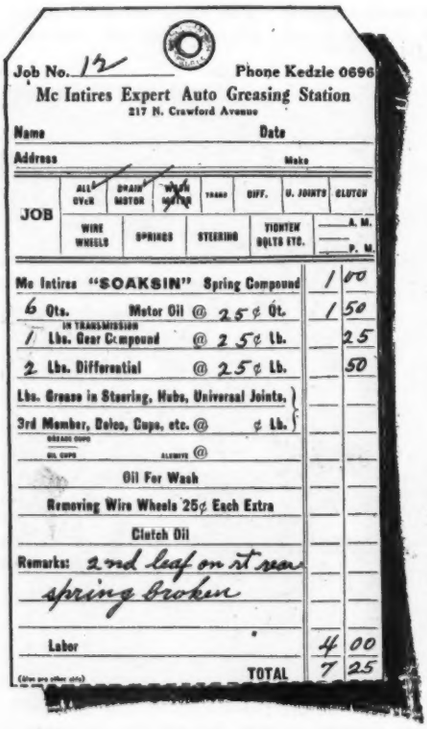
Yours for better service,

LORD MOTOR CAR COMPANY

By Barry Lord

HAL/MEM.

The letter above shows how one dealer is systematizing his service to customers. The letter is well written and makes an offer that every one is interested in, namely, the offer to save a man money



Job No. 12 Phone Kedzie 0696

Mc Intires Expert Auto Greasing Station
217 N. Crawford Avenue

Name Date

Address Make

JOB: ALL OVER | DRAIN MOTOR | WASH MOTOR | TRANS | DIFF. | U. JOINTS | CLUTCH | WIRE WHEELS | SPRINGS | STEERING | TIGHTEN BOLTS ETC. | A. M. | P. M.

Mc Intires "SOAKSIN" Spring Compound	1	00
6 Qts. Motor Oil @ 25¢ Qt.	1	50
IN TRANSMISSION 1 Lbs. Gear Compound @ 25¢ Lb.		25
2 Lbs. Differential @ 25¢ Lb.		50
Lbs. Grease in Steering, Hubs, Universal Joints, 3rd Member, Delco, Cups, etc. @ ¢ Lb.		
GREASE CUPS OIL CUPS ALEMITE @		
Oil For Wash		
Removing Wire Wheels 25¢ Each Extra		
Clutch Oil		
Remarks: 2nd leaf on rt rear spring broken		
Labor	4	00
(Give no other city) TOTAL	7	25

Charge tag used by large oiling and greasing station. This station used a special spring oil and charges separate for it. Note that under remarks attention is called to a broken spring leaf. The customer appreciates this concern in his interests; it is part of the good will building necessary to the success of this business

Importance of Periodical Oiling

All this has attached a new importance to the necessity of periodical and proper lubrication service, and the result is being reflected in car owners having the work done more often. Another angle of the more frequent changing of crankcase oil is the vast amount of oil taken out and formerly thrown away because of its diluted condition. This was a tremendous economic loss, and equipment has been developed which makes it possible to reclaim this discarded oil and make it even better than it was before it was used in a crankcase.

Reclamation of this old oil opens a new field of opportunity for some dealer or maintenance specialist in every community. The capacity of one of these oil reclaimers on the market is about 80 gallons of renewed lubricant from 125 gallons of diluted oil in 10 hours. Cost of operation averages about 15 cents per gallon, and with quality oil selling at around $1 per gallon, the margin of profit and possibilities of such equipment are very gratifying. It is estimated that such a device could be profitably operated if kept running at half capacity. This would require reclaiming of about 65 gallons per day and would produce 40 gallons of fresh, pure oil of a quality which has been scientifically certified to be even better than new oil, because of some of the carbon having been removed in the process of rejuvenation. There are great prospects in reclaiming diluted crankcase oil, and to any man located in a territory with a potential waste of 65 gallons of diluted oil per day or better, the suggestion is offered for what it is worth.

Shellacking Bolts

Customarily, oil, grease or graphite is used as lubrication where nuts are replaced after a car has been worked on. This is ordinarily good practice, for where graphite is used it permits the nut to be set down closer and at the same time it is removed easily. But under the car, on body bolts, fender nuts and, in fact, any place where water reaches the nut and bolt there is little that will prevent a nut from becoming so rusted on, that something must give way if an attempt is made to remove it.

Some form of paint or japan frequently is used, but even this will wear off in time and then the rust will continue to accumulate.

To prevent any further accumulation of rust, dipping both the bolt and nut in thin shellac and applying a little more where the nut has taken it off the bolt during application is efficacious, and when the nut is to be taken off again, the job is performed easily. At the same time the shellac will tend to hold the nut from turning itself off, and it will also act as a cushion to prevent rattling, in case it happens to loosen a little.

250 SPARKS PER SECOND

Tremendous Duties Imposed Upon the Ignition System of a Straight Eight Engine in a 500-Mile Race—How Battery Ignition is Designed for Successful Operation at Sustained High Speeds

By A. H. PACKER

THE design of battery ignition for use with high speed engines, especially where those engines have more than the customary four or six cylinders, involves a number of problems which should be of special interest in view of the fact that the impression has prevailed that battery ignition was effective only at comparatively low speeds and that sparks from a battery ignition system were necessarily very weak at high speeds.

While it is true that any battery ignition system will have a speed at which the heat of the spark begins to decrease, it is still perfectly possible to have that speed above any desired point so that from a practical standpoint the solution is not so complicated as it may first appear.

Before considering details of design which make high speed operation possible, we will consider the circuits in Fig. 1,

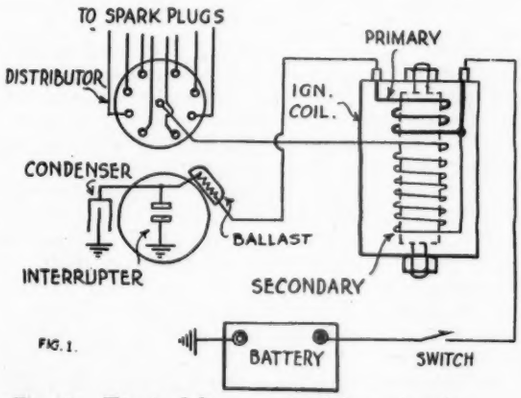


Fig. 1—Typical battery ignition circuits

which show typical battery ignition. The source of energy is customarily a storage battery which is also used for the other current requirements on the car. The usual method is to ground one terminal of the battery and connect the other terminal through the ignition switch to the primary of the ignition coil. Current through the primary of the ignition coil then goes across a pair of interrupter points to ground and back to battery. In the circuit in question a ballast coil is also shown in the circuit and its function will be discussed later.

The production of high voltage spark from a low voltage battery is based on the ability of rapidly changing magnetism in the ignition coil to produce a high voltage in the fine winding, or secondary, which voltage is capable of producing the spark at the plugs. When the ignition switch is closed and the closing of the interrupter points allows current to flow, the action is to magnetize the iron core in the ignition coil. This rise in magnetism, however, generates a back voltage, or counter E. M. F., which has the effect of making the current rise slowly. For this reason, an appreciable time is required to get the iron core of the ignition coil magnetized. It is this fact which presents the chief obstacle in designing battery ignition for extreme speed work. It is also this condition which causes a slow rise in the magnetizing current which prevents getting a spark from the secondary when the interrupter points close.

When the interrupter points open we have, instead of a magnetizing action, a demagnetizing action, and in this case there is also generated a counter-voltage which now tries to help the battery maintain the current through the coil. This effect produces the arcing at the interrupter points, and it is only the use of the condenser across the interrupter points which enables us to absorb the arc and suddenly stop the primary current. This sudden stopping of the primary current gives a much more rapid change in magnetism than we were able to get when the current started to flow, so that the secondary is now able to produce a very high voltage and the spark which is carried through the distributer to the proper spark plug is made possible by this sudden change in magnetism and always occurs when the interrupter points open, never when they close.

Time Available for Producing Spark

We will now take the case of a four cylinder engine running at 25 m.p.h. and on the average car this is the equivalent of about 1,000 r.p.m. of the engine. As each cylinder requires a spark every other revolution, the 1,000 r.p.m. speed of the engine means that the interrupter shaft in the ignition unit it turning 500 r.p.m. However, as it must have four points on the cam, so as to produce four sparks, there will be 2,000 sparks per minute produced. Dividing this figure by 60, the number of seconds in a minute, we find that there are 33 1/3 sparks per second produced or, looking at it the other way, .030 second per spark.

We will now consider the time available for the production of each spark in the case of a racing car equipped with an eight-cylinder engine where at 98 m.p.h. the engine speed would be approximately 3700 r.p.m. We would now have 1850 sparks per minute for each cylinder and multiplying this number by 8 gives 14,800 sparks per minute required for all eight cylinders. Dividing this by 60, we find that the ignition outfit must develop 246 2/3 sparks per second, or we will say roughly 250 sparks per second, so that the time available for the production of each spark is .004 second compared with .030 second for the slow-speed four-cylinder touring car.

This shows that the ignition for the racing car must be seven or eight times as fast as the ordinary type ignition coil in order to be satisfactory.

To get a mental picture of the conditions involved we will now refer to Fig. 2, where in the upper sketch we show a curve which represents the value of the battery current through the primary coil at any particular time. Time is shown by the horizontal line and the value of the current is shown by the vertical height of the curve at any point. When the breaker points open the current drops suddenly from its high value down to the zero line, then when the breaker points close the current starts to rise slowly, the slow action being due to the back E.M.F. or counter voltage generated by the rising magnetism in the ignition coil.

In the upper sketch the rising current gradually gets to its

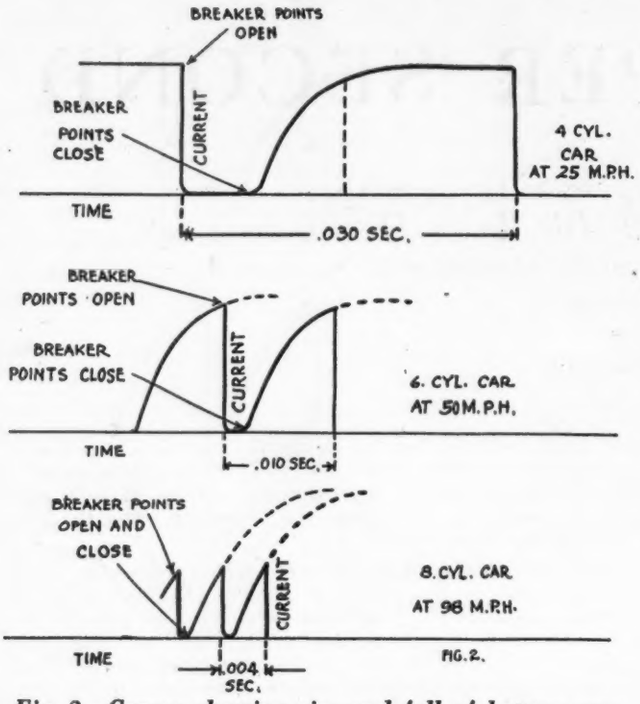


Fig. 2—Curves showing rise and fall of battery current in ignition coils

maximum value and a little later on, the interrupter or breaker points open again, which opening produces the high voltage in the secondary which supplies the spark to the plugs. In this upper sketch along the horizontal line which is marked "time" we show that the time available is .030 second from one break to the next.

We will now consider the operation of a six-cylinder car at 50 m.p.h., which is comparatively high speed for ordinary usage. The doubling of the speed and increasing the number of cylinders by 50 per cent will give us three times the relative speed as far as the ignition device is concerned, so that we have only 1/3 of the allowable time available to produce a spark. Using the same ignition coil and interrupter, designed with six points on the cam instead of four, we find that as the current rises it is nearly able to reach its maximum value before the breaker points open, although as seen by the dotted extension of the curve in the second sketch in Fig. 2, the current would rise in the primary winding of the ignition coil a bit higher if the additional time had been available. As the current is slightly below the maximum the magnetism will also be slightly reduced and the strength of the secondary spark will therefore be a little less than in the case of the four-cylinder car, although the difference is here not enough to cause any appreciable trouble.

On the same basis we will now take up the case of the eight-cylinder car traveling at 98 m.p.h. and the curves for this are shown in a lower sketch in Fig. 2. Here it will be seen that where only .004 second is available, the current in the primary rises to barely half of its maximum value by the time the breaker points open, so that the magnetism being very weak the secondary spark will also be very weak and accordingly unsuitable for use in the racing engine.

We now come to the possible methods available for overcoming this difficulty and as there is no way of increasing the time available we must find some way of making the coil build up faster. As the slow action is due to the back E.M.F. in the coil, which is produced by the number of turns, it is immediately evident that if we could reduce the number of turns in the coil we would have a coil which would magnetize faster. Assuming for example that our slow speed coil had 300 turns in the primary and used five amperes. If we would cut the number of turns to 150 and allow a 10-ampere peak to flow, the ampere turns or magnetizing force would still be the same but due to having less turns the coil would magnetize quicker.

Referring now to Fig. 3 we see a curve which rises to a value about twice that of the curve in Fig. 2 due to the fact

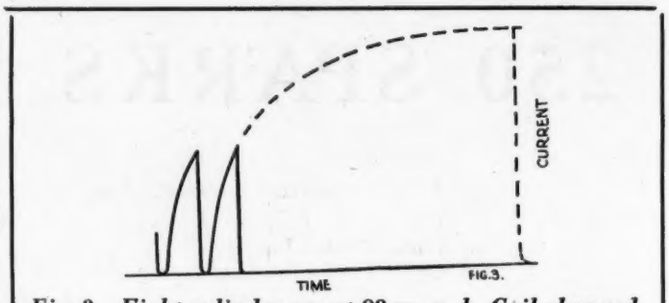


Fig. 3—Eight-cylinder car at 98 m. p. h. Coil changed to give stronger spark

that it represents the action of a coil designed to have less turns and use greater current from the battery.

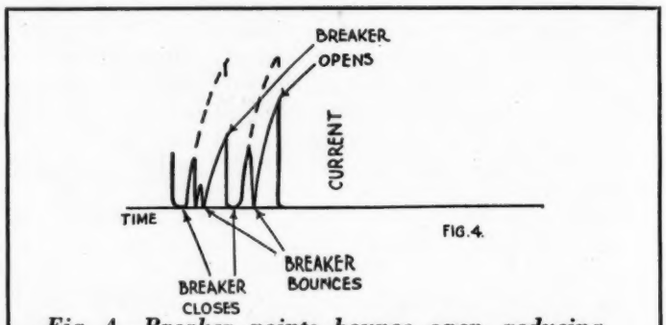


Fig. 4—Breaker points bounce open, reducing strength of spark

Bouncing of Interrupter Points at Higher Speed Weakens Spark

Referring now to Fig. 4 we see the general nature of the action that takes place in case the interrupter points at high speed do not immediately make contact when released by the cam but bounce once or twice before coming permanently together. The first contact starts current building up in the primary and the bounce or accidental breaking of the circuit causes the current to die out again. Each additional contact then starts the primary current and each bounce stops it so that we may have wasted a good part of our .004 second available before the current finally starts to rise in the coil. In Fig. 4 the effect is very evident, for while the current should come up to the peak as shown by the dotted lines it actually falls far short of this point, depending on the nature of the bounce in the interrupter.

This condition has been overcome to a great extent by using

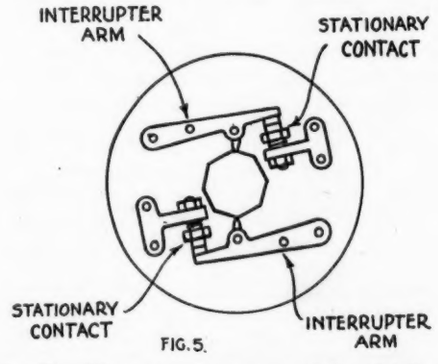


Fig. 5—Double interrupter used for high speed engines

double interrupters as shown in Fig. 5, where two pairs of contacts separate at the same time and are used in parallel. The theory of this design is that even assuming that both pairs of points have a certain amount of bounce to them they are not

likely to both open the circuit at the same time and if either one is in contact while the other is open the trouble indicated in the sketch in Fig. 4 will not be experienced. The use of two pairs of contacts in parallel is also an advantage in case a coil is used which draws a fairly heavy current, as the arcing of the point will be excessive if only one pair of contacts is in use, but with the current divided between two pairs will be reduced to a point where the surface of the contacts will not be appreciably burnt.

Function of the Ballast Coil

The ballast coil shown in Fig. 1 is a resistance which in racing is used chiefly for the reason that it gives a comparatively heavy current to the coil at high speed compared to the current at low speed, although of course the high-speed current is bound to drop off somewhat. It is made of either iron wire or nickel wire, which has the property of increasing its resistance when it becomes hot. This property is also

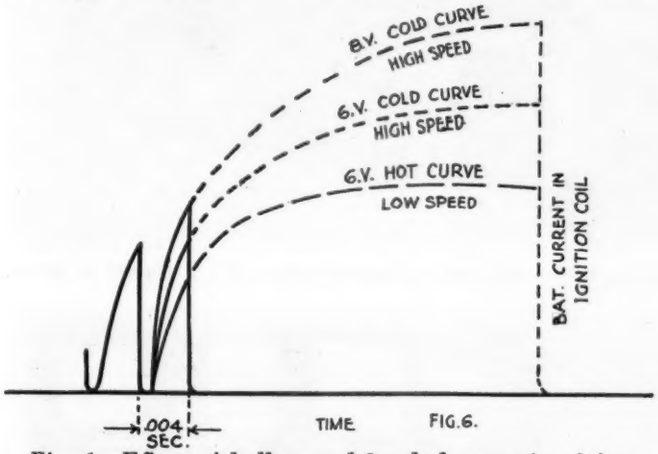


Fig. 6—Effect of ballast and 8-volt battery in giving hot spark at high speed

noticed in copper wire but to a less extent. A copper wire having a resistance of one ohm at the temperature of freezing water will have a resistance of approximately 1.4 ohms at the temperature of boiling water. Nickel and iron wire, however, through this same change in temperature increase from 1 ohm up to approximately 1.6 ohms. While this difference does not seem to be very great, the use of iron or nickel is also dictated by the fact that its natural resistance is higher for a certain size piece of wire, so that to get a half-ohm or one-ohm coil in a small space is an easier matter with the iron or nickel than it would be with copper.

We will now assume that the primary winding itself in our ignition coil has a resistance of .6 ohms and that the ballast when cold has a resistance of .3 ohm, so that the total primary circuit resistance would be .9 ohm. We will now assume that when hot the ballast heats up to the point where its resistance is double, so that we have .6 ohm in the primary as before, while the ballast is now also .6 ohm, making a total of 1.2 ohms for the primary circuit, or an increase of 1/3 in the primary resistance. In operation this will, of course, be accompanied by a decrease of 1/3 in the current peak.

We will now assume that the hot condition is the standard one for running at comparatively low speed where each time of contact is long enough for the current to rise to its maximum valve. This will be represented by the lower curve in Fig. 6, which is shown as a dash line extending over to the right. When the same engine, however, is run at high speed the circuit is broken so rapidly that the heating effect of the current is a great deal less so that the ballast will not continue to run hot but will cool off considerably. This means that its effective resistance has been lowered and that the current will be relatively increased.

The second or middle curve in Fig. 5 will now represent the operation, although of course the current is now allowed to flow as represented by the dotted lines, but is cut off by the opening of the breaker point at the end of the solid line. The 8-volt battery used in place of the 6-volt battery at the Indianapolis races would have the further effect of raising the current as shown by the upper curve where the breaker again opens the circuit as indicated by the solid line and the dotted line merely represents the theoretical extension of this curve.

Summary of High Speed Design Details

In conclusion we might say that the design of battery ignition for use with multi-cylinder engines at high speed is accomplished by one or more of the following constructions:

1—The use of a ballast coil.
2—The use of double interrupter.
3—Increasing the battery voltage.
4—Change in coil design.

While in most cases at the Indianapolis races the coil design was not changed from standard six-volt practice, it is possible to do this and the use of 8-volt batteries giving satisfactory operation apparently made this unnecessary.

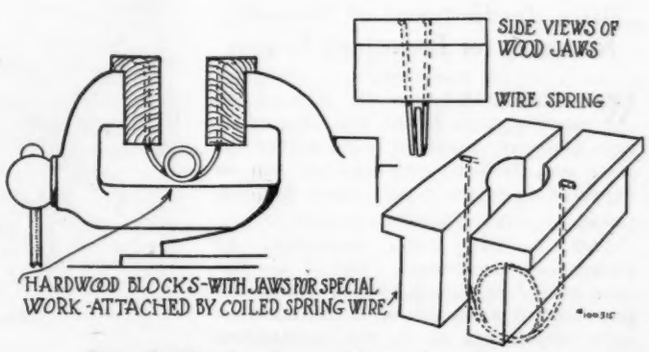
To the casual observer the use of an 8-volt battery on a 6-volt system might make it appear that such a change could also be made on any standard touring car, but it must be considered that this was only an emergency measure made possible by the fact that at extremely high speed the current in the ignition coil does not have a chance to rise to its maximum value, and if these same cars should be used for ordinary purposes, such as touring at moderate speed, the 8-volt battery would send enough current through the ignition circuit to cause the coil to run abnormally hot, which would, no doubt, ruin it in a short time.

If an 8-volt battery were installed on an ordinary car, where starting motor and generator were employed, it would be observed that the starter would crank the engine more rapidly than with a 6-volt battery. As the generator field winding, however, would be connected up to the 8-volt battery its heating would be excessive, as it varies with the square of the voltage, and an increase of voltage from 6 to 8 would produce a comparative increase in heat from 36 to 64, or approximately a 75 per cent increase in the amount of heat generated in the field winding. As most automobile equipment is designed as compactly as possible there is usually no leeway for additional heat or overload.

It should be evident from the above analysis that the change in battery voltage should only be made under abnormal conditions such as in the racing car installation described and that its general use might lead to disastrous results.

Hardwood Jaws for the Vise

The accompanying illustration shows a special form of detachable jaws for the vise, with a spring holder that keeps the parts from falling out each time the vise is opened for the purpose of removing the work. The faces of the hardwood parts are made to conform to the shape of the metal or other part being worked on. These sections of block are joined below by means of a piece of spring wire wound into several turns. The points are driven into the blocks. Apart from the general utility of jaws which conform to the special shape of the part, thus permitting them to be used on soft castings without danger of defacing them, this arrangement has the added advantage of keeping the blocks from being separated when not in use.



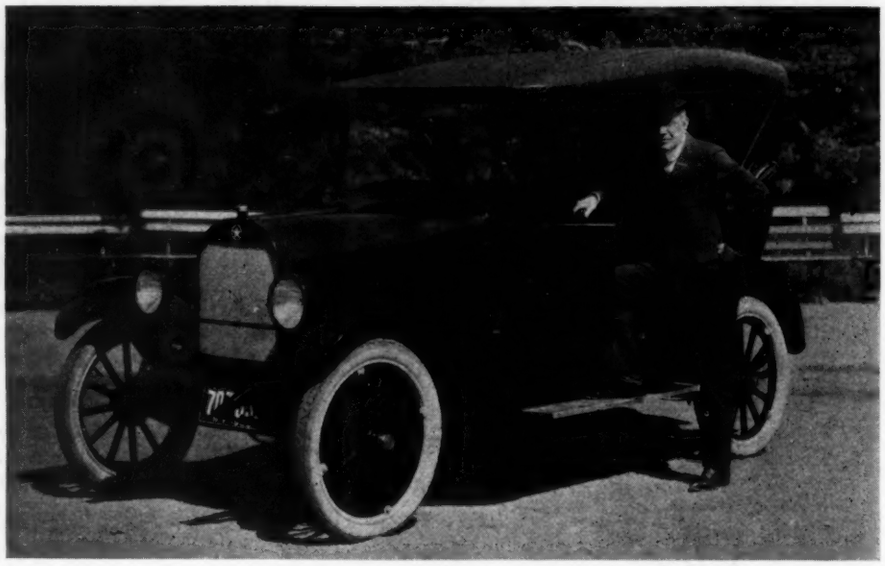
Detachable hardwood jaws for the vise

New Star Body Models on Display

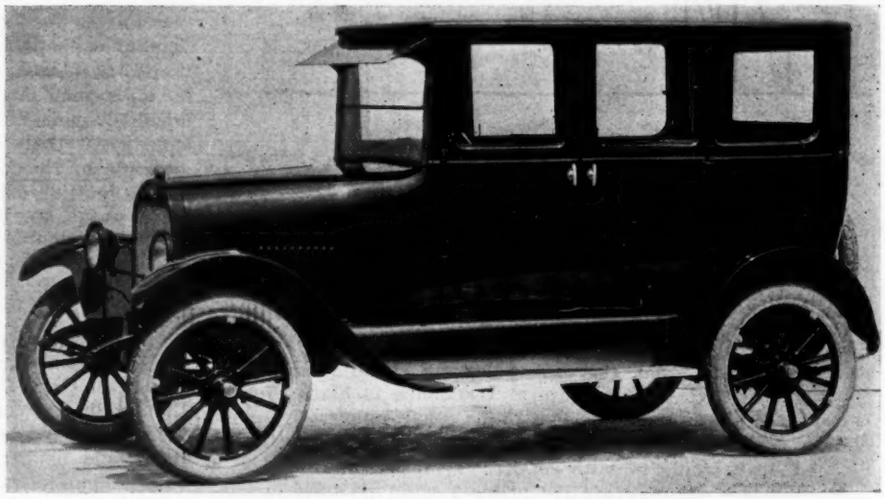
NEW YORK, June 17.—The Star chassis and the five body models which are to be marketed by the Star Motors, Inc., are now on exhibition. A few relatively unimportant changes have been made in the chassis since it was shown in Washington on March 9, but the car remains essentially as it was at that time. The roadster, coupe, sedan and delivery bodies are shown for the first time, these together with the five-passenger phaeton, already described in these columns, completing the line. The roadster and phaeton bodies are largely of metal and are conventional in lines and most other particulars. These bodies are to be assembled at the various plants where the cars are assembled, while the closed bodies will be purchased outside.

A substantial tire carrier has been added to the rear of the chassis frame and conventional running board brackets are to be used without the angle iron brace between them under the gearset, which was shown on the first chassis. The worm and worm wheel type of steering gear is to be furnished by the Warner Gear Co., which also supplies the gearset. The lower end of the worm wheel spindle is bent forward below its guide, thus forming an integral steering arm. The rear end of the gearset is supported on the two brake shafts which are pivoted at each end in the main frame. Brake rods are of flat steel with forged ends welded on. The battery box is formed from flat strip stock bent to shape and hooked over the cross member to which the gearset is bolted.

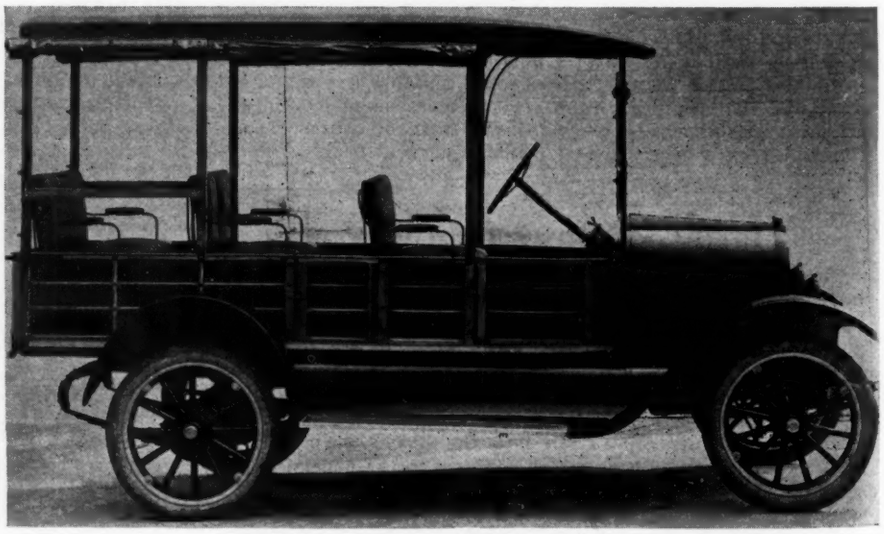
The Morse chain used in the engine can be adjusted by rocking the generator outward. The water pump is driven off the rear of the generator unit through a flexible hose-type coupling, which takes care of the change in alignment when the generator is moved. The starting motor, when furnished, is strapped to a bracket cast on the crankcase on the right side below the water pump and is provided with Bendix drive. It can be easily attached if purchased separately.



Star phaeton, $348, or $443 with starter and demountable rims. W. C. Durant in picture



Star sedan, $645, with starter and demountable rims



Star station bus body model

Says Owners of Automobiles Must Pay More of Road Costs

Chief of U. S. Bureau of Roads Declares Readjustment of Financing Necessary for Permanent System

WASHINGTON, June 19—A readjustment of taxes in the financing of future highways must be made before the state and Federal governments can be expected to foster a permanent and national highway transport system.

This is the belief expressed by Thomas H. MacDonald, chief of the Bureau of Public Roads, United States Department of Agriculture, in an interview with MOTOR AGE as to the outstanding difficulty in the construction of a great

national highway transportation system, extending from coast to coast and serving the greatest number of people possible.

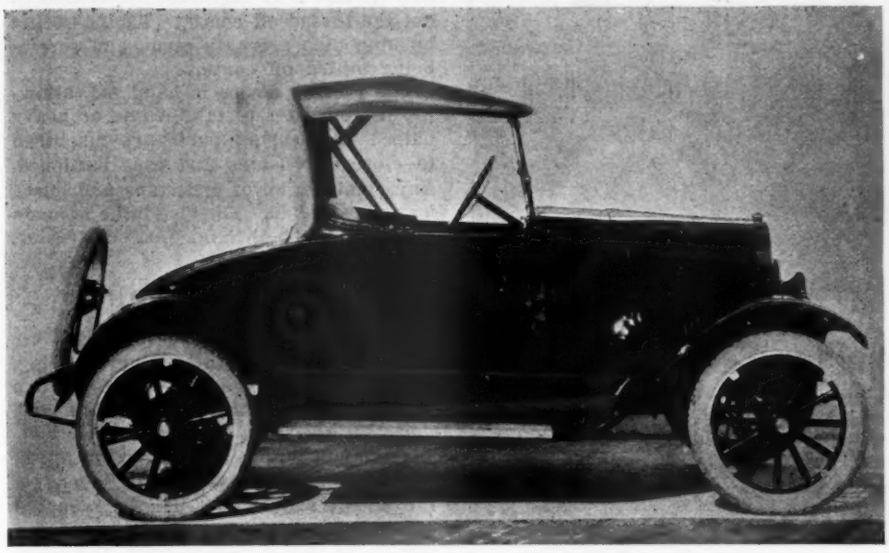
The Bureau of Public Roads estimates that of the $600,000,000 spent for highways last year 33 per cent was Federal aid and motor-vehicle revenue. The remaining 67 per cent comes either directly or will eventually be paid from state and local taxes. A larger percentage of the taxation must be borne by the automobile user and a lesser percentage from state or local taxes, MacDonald declared.

"We are starting out to construct a system of highways such as no nation ever constructed before for the nearly 11,000,000 automobiles now in use and the millions more to come. The nearest approach to our present program is found in France and Germany, and the area of neither is as large as Texas," MacDonald said.

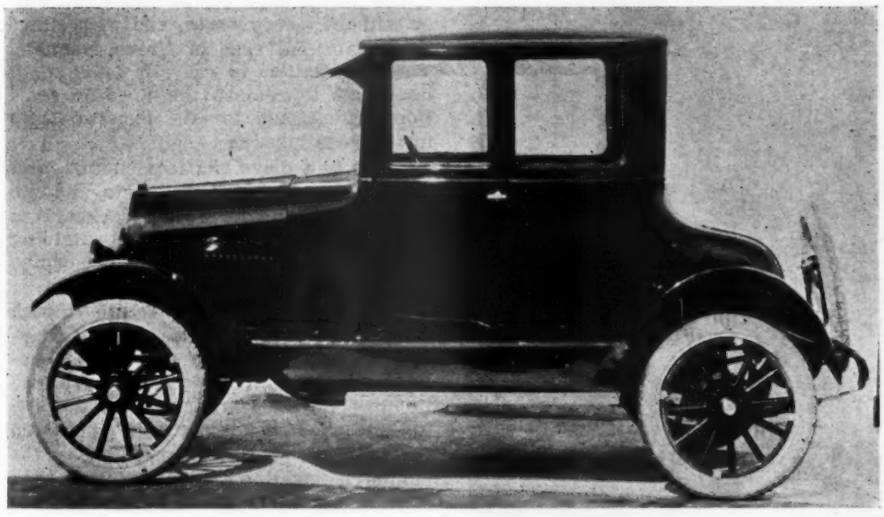
"This great undertaking is being entered into because highways are not a luxury but furnish a real service, have a real earning capacity, and have become a national necessity. For such an undertaking to be successful, financing, to care for maintenance, reconstruction, and new construction, should be planned for a long period of years in advance. Changes in methods of raising funds every few years, uncertainty as to whether funds will be provided, and periods in which funds are not provided, all increase the final cost of highways. Such a policy would soon bring any private business to disaster.

"Development and increase in numbers of motor vehicles and the coincident need and demand for good roads have come so rapidly that methods of raising funds have often been expedient for the time being. Consideration has been given not so much to the joint distribution of the cost as to how the funds can be raised with the least controversy and the utmost ease. Then, too, the use made of the highways and the service rendered by them has changed greatly within the last few years.

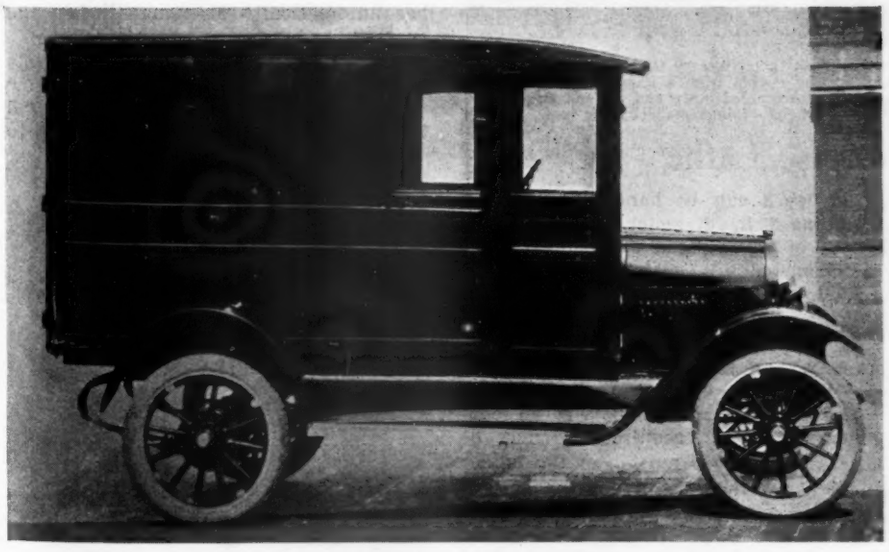
"All this leads to the inevitable conclusion that the whole situation must be gone over very carefully, traffic studies made, and the cost distributed in proportion to the service rendered. There must undoubtedly be a readjustment of the sources of revenues so that a larger percentage will be paid by the road users and a lesser percentage from state or local taxes."



Star roadster, $319, or $414 with starter and demountable rims



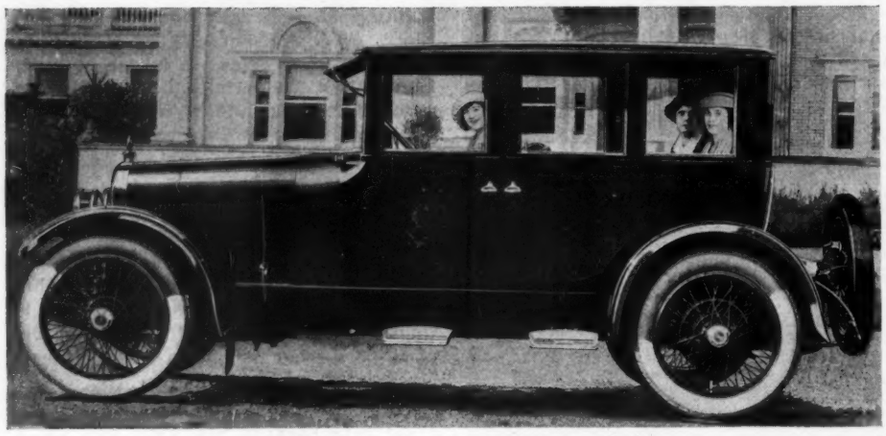
Star coupe, $580, with starter and demountable rims



Star light delivery body model

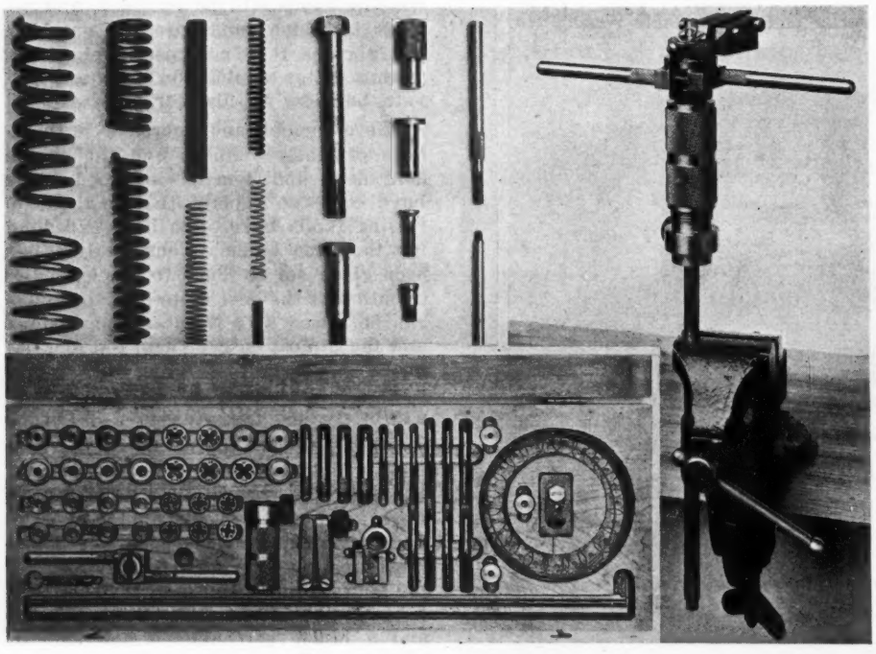
THEFT RING BROKEN UP

Milwaukee, Wis., June 19—Interstate traffic in stolen automobiles by the largest automobile theft ring ever uncovered in southern Wisconsin has been checked by the capture of several members of the gang by Milwaukee and Kenosha police. Four men are in cells at police headquarters here, eight automobiles have been recovered and police believe that within a short while they will have in custody two more of the alleged automobile thieves. All of the automobiles so far recovered were stolen in Milwaukee and several of them sold in Racine. Others were taken to Kenosha and transported across the state line. Licenses had been changed, some cars had been repainted and numbers substituted in others.



Chandler Metropolitan Sedan

THE Metropolitan sedan just announced by Chandler is featured by four exceptionally wide doors and individual aluminum steps. The body is Fisher built and all interior metal accouterments are of Colonial design, executed in dull silver finish. Upholstery is carried out in mohair velvet. Other characteristics include a nickel finish radiator, barrel type lamps, trunk rack fitted with horizontal and vertical polished aluminum bars.



Lower left—Tool knocked down and packed in its box with the necessary taps, dies, bushings, cutting tool, spacers, etc. Right—Tool set up and cutting a chip from a bar held in a vise. The lower portion of the bar shows where a shoulder has been milled down and the end knurled by the tool. Upper left—Various studs, screws, pins and springs made by the tool.

Ramsdell Hand Vise Lathe

THERE has been placed on the market a tool which makes it possible to turn from bar stock without the use of an engine lathe or automatic screw machine milled studs, set screws, cap screws, pins, and other screws and studs used in automotive work. In addition springs with any desired pitch may be wound.

Bar stock up to and including 1 in. in diameter can be handled, thus enabling the operator to make hexagon head cap screws up to and including ⅝ in; square, fillister and round head cap screws up to and including ¾ in. and flat head cap screws up to and including 9-16 in.; button head up to and including ⅝ in. Other work can be handled up to and including 1 in. diameter. Any required length of screw, stud or spring can be easily made.

Each set is furnished with centering bushings from ¼ in. up to and including 1 in. by sixteenths of an inch. Both standard and S. A. E. dies and taps are also part of the equipment.

The die and tool holder is so constructed that the required die may be fitted in the upper portion of the holder and a centering bushing of the correct size in the lower portion. The distance between the center of the die and the center of the centering bushing is 9-16 in., thus giving a long bearing for the stock to be threaded. The stock to be threaded first passes through the centering bushing before being engaged by the die and it is therefore impossible to cut the thread off center. The centering bushing also prevents studs and screws being milled off center.

The feeding device is hand fed, allowing the operator to take a fine or heavy chip. All wearing parts are machined to close dimensions and case hardened. Any combination of dies, taps and bushings may be had. The vise lathe is made by the Campbell Mfg. Co., Worcester, Mass.

Bosch Has Two New Fordson Accessories

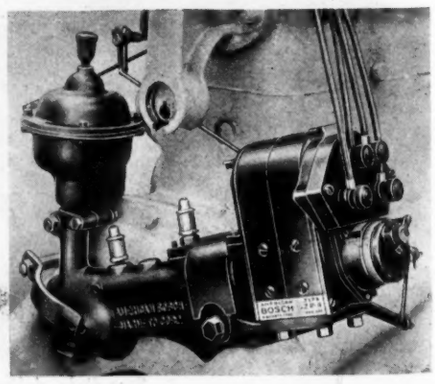
IN ORDER to obtain more even firing, and therefore better operation than can be obtained with vibrating coil ignition, the American Bosch Magneto Corp. has brought out a Bosch magneto fitting for Fordsons. It has also brought out a Bosch governor which can be mounted directly on the magneto fitting, being driven by the camshaft gear, the same gear used for driving the magneto.

The new fitting can be supplied with or without the governor, and with either the ZR or DU type of Bosch magneto. The installation is easy, it being only necessary to remove the Fordson ignition system, and to take out two bolts in the gear housing.

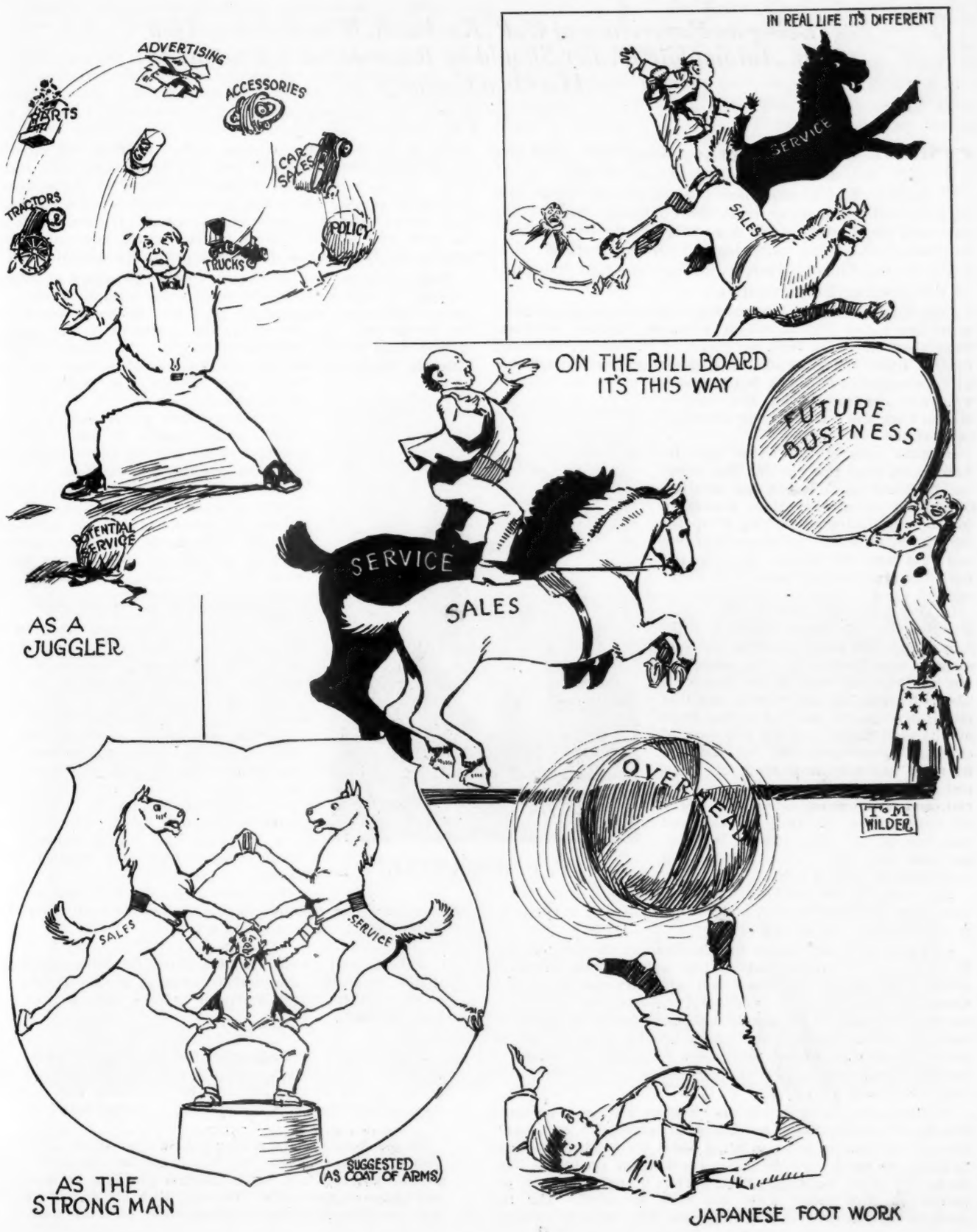
There is a drive shaft extending from the engine camshaft to magneto, and one set of spiral gears. The bracket is a heavy malleable iron casting containing large bronze bearings and big engine oilers.

The attachment comes equipped with either the Bosch impulse starter coupling or with the Bosch adjustable coupling. It is preferable to secure the impulse starter coupling because starting is easier. It automatically speeds up the rotation of the magneto when the engine is starting or operating at low speeds, thereby producing a spark of the same intensity as is developed when running at high speed. The impulse member automatically disengages when the engine speeds up.

The governor automatically controls the gas intake, cutting down the flow when the engine tends to speed up, and increasing it when the engine begins to slow down.



NOW THAT CIRCUS TIME IS COMING 'ROUND AGAIN, THE DEALER IS REMINDED OF HIMSELF



A Well Established Reputation Brings Easy Profits in Car Sales

Being an Experience of C. P. Rockwell, Who Believes That an Automobile Dealer Should be Regarded as a Prophet in His Own Country

THERE are many ways of selling cars. No two men will ever quite agree as to details. C. P. Rockwell of Boston likes best to sell the reputation of his establishment and his merchandise, and let the cars sell themselves. He does this chiefly by "selling" the members of his organization on the methods that build for the future. Here is an incident that is typical of the Rockwell organization:

Last fall a man stopped in the Rockwell maintenance department and asked Superintendent Brennan a number of questions about putting a Nash car away for the winter. Brennan did not know the man and by questioning him learned that he represented a friend, a Nash owner, who was confined to his bed with a broken knee and was worrying about his car and the cold weather.

Brennan assured the friend that he would look after this car and that evening he drove 15 miles to the invalid's house, did all of the things necessary for the car, including jacking it up for the winter, went into the house to smoke and chat with the injured man and the next day reported the incident to Rockwell.

In the course of time the knee was mended and the former invalid drove into Boston and about the first place he stopped was Rockwell's. He asked for his bill, but was sent to see Rockwell. The latter recalled the incident and told the owner that he was not in the habit of charging people for the privilege of entertaining his employes. He said that Brennan had told him about the visit and said that he had greatly enjoyed the call, and so he thought that was about all there was to it. Only he was glad that one of his associates in business had had this opportunity of helping a man when he needed help.

C. P. ROCKWELL

The man with the bad knee, of course, became a Rockwell booster, and according to last reports, he is still working on the job.

Rockwell does not regard this incident as an isolated one. It is the sort of thing that he has had in mind for many years. He was one of those men who attained the proper vision of the automotive merchandising business years ago. He was one of those who realized that the future of this business was not so much in the money laid by from the sale of one car, nor even of the percentage of profit, but rather of building a prestige that would make selling easier and cheaper each succeeding year.

Rockwell also knew that if his business developed, he could not do all of the things necessary to accomplish this result himself and that in order to bring about the condition he had in mind, he must have his entire force keyed up to the idea. So he set about building. Each person brought into the organization was tested with this view in mind. The immediate earning power of this person was entirely subordinated to his disposition to make himself fit in the big scheme. It has been slow work. The war and its demands were much more keenly felt in this organization than in those where immediate earning power and personal brilliancy are the tests. But the war also was something of a test. It gave a clue as to those who wished to work for the future, and many were true to the Rockwell ideal and returned to the old colors.

Progress since then has been rapid. The slump in selling was not permitted to interfere with the building work—and indeed this period supplied the proof that Rockwell was working on the right line, for during that period of careful buying, a good many persons found their way into the Rockwell establishment because of the recommendations of persons who had come into contact with these future building methods.

During the last winter Rockwell has found many reasons to thank himself for this vision and his determination to meet the conditions he foresaw.

A particular point in Rockwell's ideals is the selection of the merchandise. He is not and never has been an opportunist. He holds to the belief that the future of the car he sells means much more than the question of discount.

Everybody a Square Deal

The method of inducing him to drop his present line and taking up another car would not be to talk discounts, but to show him that the proposed line had greater possibilities than the one he is selling. Also it would be well for the salesman who sought to induce him to change, not to disparage the present line, for Rockwell is the sort of a man who looks before he leaps and his ideas of the stability of his present merchandise was formed after mature consideration and the man who would disparage it would need to come well fortified with facts.

One naturally asks if a man of this sort brings direct results. In Rockwell's case many incidents could be recited. Here are just a few:

—:—

A Vermonter recently sent a check for $100, explaining in the letter that his daughter wanted a car in about 10 weeks and he asked Rockwell to pick out the car and have it ready.

—:—

A local man in completing the purchase of a car remarked: "I told the tire man in our neighborhood that I was going to buy a new car and he suggested that I come here because he knew I would get a square deal."

—:—

At the Boston show a man paid a deposit on a car and two days later asked that his order be cancelled. His deposit was returned, but in another two days he was back and renewed the order. He said that his second change was brought about by a conversation with the man at a

filling station who told him that he was making a mistake in not buying of Rockwell "because they give everybody a square deal there."

—:—

Rockwell sent out a letter to his Nash owner asking them to suggest names for his prospect list. Some replies were received by mail, but more were obtained by persons who drove to the salesroom especially to talk about the persons whose names they were suggesting. Within two weeks 30 cars were sold to the names so obtained.

—:—

These are not isolated cases, rather they are typical. It is this sort of a feeling that made the first quarter of 1922 slightly more than 200 per cent better than the same quarter in 1921 and made April, 1921 (you all remember that period), the best month in the firm's history to that date, but April, 1922, went ahead.

It was after this reputation was established that this line appeared in Rockwell's advertising:

"Our Reputation is your Protection."

The Touring Season Gives the Electrical Station an Opportunity to Serve Its Customers

WHEN the electrical requirements of the car are considered, it is usually felt that conditions are somewhat different in summer from those that exist at other times. In the case of the battery we find overheating due to the increased temperature of the engine heat which is carried toward the rear of the car. The charging current supplied by the generator is also more effective in keeping the battery charged, and in flowing from the generator windings produces heat in them also. All of these things are due to normal conditions of driving.

Then when the car owner goes touring all of these conditions that are detrimental to the electrical system are aggravated and injury to the battery and generator are frequently encountered.

A sign reading,

"Let Us Check Your Electrical System Before You Make That Long Trip. Let Us Adjust Your Generator. We Know How."

might bring in business that would otherwise go by.

While it is not possible to give figures that will be absolutely right for every car, the following will prove helpful in setting generator charging rates for summer conditions.

Battery Amp. Hr. Rating	Charging Rate for 3 Hr. Runs	For 6 Hr. Runs as When Touring
40	5	3
50	6	3
60	7	3
70	7.5	3.5
80	8	3.5
90	9	3.5
100	9	4
110	9	4
120	10	4

The method of adjusting charging rates on most cars is by shifting the third brush against the direction of rotation. On cars having voltage or current regulators, the spring tension on the regulator is reduced to lower the charging current. Generators having reverse series or bucking field regulation can not be adjusted, and require the use of some device for consuming the excess current generated. This gives an opportunity to not only sell such devices, but also get the job of installing them and even in the case of third brush generators such devices can be used for disposing of excess current, which protects the battery although it fails to relieve the generator of its heavy load.

The well-known "call of the wild" is strongly sounded in this window display, the work of the A. L. Englander Co., Cleveland distributor for Hupmobile. Several weeks were required to complete the "set," but the comment upon the result has justified the effort. The Englander company believes that real sales appeal is contained in the work and that there can be little doubt as to its "going over." Grand Canon scenery is used as a background for the Hupmobile roadster. The blending of the work is readily seen and, as window displays run, is very highly commendable.

MOTOR AGE

Reg. U. S. Pat. Off.
PUBLISHED EVERY THURSDAY

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Vol. XLI Thursday, June 22, 1922 No. 25

THE CLASS JOURNAL COMPANY

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SUBSCRIPTION RATES

United States, Mexico and U. S. Possessions	$3.00 per year
Canada	5.00 per year
All Other Countries in Postal Union	6.00 per year
Single Copies	35 cents

Subscriptions accepted only from the Automotive Trade

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; A. C. Pearson, Treasurer; Fritz J. Frank, Secretary.

Entered as second-class matter Sept. 19, 1899, at the post-office at Chicago, Ill., under the Act of March 3, 1879.

Member of Associated Business Papers, Inc.

Member of the Audit Bureau of Circulations.

As to Dealer Advertising

THERE was a good deal of discussion at the recent meeting of the factory advertising managers as to the assistance extended to dealers for local advertising. Also there were indications that a number of the manufacturers are thinking of discontinuing these helps. The manufacturers are thinkng that the automotive industry is well enough established for the dealers to stand on their own feet, in advertising and a few other particulars. They are drawing comparisons between practices of the automotive merchant and merchants in other lines.

Also it appears that very few advertising departments of factories are extending advertising assistance indiscriminately. The present idea appears to be that when the local merchant takes himself and his work seriously and is ready to go ahead aggressively with the selling of motor vehicles, the advertising department of the factory is ready to cooperate with him. First the dealer must express the desire for local advertising; then he must study the factory plans sufficiently to be acquainted with the policy and understand it; next he must adopt this policy and indicate that he has an understanding of the purpose and dignity of advertising, and finally that he wants to forge ahead in business and create a sales department in keeping with other efforts.

This is as it should be. Several advertising managers told of results where the dealer was given a free hand with the advertising. Soon they were receiving bills for advertisements on picnic dodgers, burlesque theater programs, foolish novelties and other means that lacked the dignity that should accompany a motor car advertisement.

The frame of mind of the factory advertising manager appears to make himself as helpful as possible to the dealer as long as the dealer will be intelligently helpful to himself.

The Opportunity

THE Automotive Equipment Association is meeting at Colorado Springs this week. At this meeting of manufacturers and jobbers of equipment for automotive vehicles, there will be gathered some of the best production and sales minds in the country. Many of these men take a large view of their business possibilities. They know that without prosperity throughout the automotive industry and in the industrial world generally, they cannot prosper.

The A. E. A. is a big and powerful institution and its possibilities tax the imagination. There is much that it can do, despite that it has a record of accomplishment in its history. The automotive industry is still in the formative period and there is much to be done. There are ragged edges in merchandising practices. Our dealers need much in the way of education. Only a start has been made in this work.

The automotive industry organizations have been remarkably free from criticism because they have been working in the main toward the promotion of the industry rather than for the special benefit of member firms. This is a big view of business and only recently Secretary of Commerce Hoover has indicated that only associations that take such a view will survive.

There is so much opportunity for educational programs that one is puzzled as to what path to take. The A. E. A. made a good choice in the "Ask 'Em to Buy" campaign and success is predicted in the "Shop Profits" campaign. These efforts should only sharpen the appetite for even a greater and broader work in aiding the industry and for work closely in combination with other associations.

"Everyone a Salesman"

LAST summer, three aggressive men who were "born and raised" in the automobile business, took over the agency for a well-known car on Chicago's south side. They made countless improvements in the building in which they located and soon had set up a standard for neighborhood dealers as far as the actual work of maintenance was concerned.

One thing they failed to do, however, was to create about their place an atmosphere of "welcome" for the car owner. There are plenty of salesmen and mechanics about the place at all times, but a car owner, driving in, can stand in the way for half an hour before finally discovering that HE must act as his own representative and actually ASK to be sold a part, accessory or service on his car.

If these three men would gather their flock about them some spare moment during the day and instruct them that the car owner is the boss and that he must therefore receive immediate attention upon entering the place, it would be a whole lot more tasty for everyone concerned.

Norval A. Hawkins recently said that "every one in the dealer's establishment should be a salesman," and if, upon entering this building the car owner would receive a hearty greeting and a cordial "What'll it be today, Mr. Blank?" he would feel a whole lot more like buying. A service salesman, whose duty it should be to meet and take every order for maintenance work would be a bigger asset than all the boasting these men can do about their work.

And if, when the customer enters, the service salesman is busy, why shouldn't one of the other salesmen keep him busy with conversation, endeavoring incidentally to make an accessory sale? Then when the service man is disengaged the salesman can bring up the customer and introduce him, leaving him to have his wants attended to.

When the Editor Nods

FROM Indianapolis comes a call for help from Art Chevrolet. He says that in Mr. Ikert's story of the Indianapolis race, the writer referred to the Fronty Ford as being equipped with a 16-valve head. This statement, he writes, has caused even his own organization to ask about this engine head.

This is, of course, a tribute to MOTOR AGE and the belief in this magazine by those who read it. Mr. Chevrolet makes only an eight-valve head for Ford cars and Mr. Ikert was quite familiar with this mechanism and knew well when he read his own story in MOTOR AGE that he had made a mistake. How and why he did it, no one knows. It is in keeping with the actor who, after appearing in a play for 200 or more successive performances, will forget his lines. It is one of the lapses that is likely to happen to any of us in the most unexpected moment. It is in the stress of getting out a hurry-up story that such errors get through to the reader.

And this recalls a similar lapse. A Constant Potential Charging Outfit was priced at $165, when the MOTOR AGE writer of that article knew well that such an outfit could not be built for that price. But in his interest in the mechanism of this device he allowed the qualification on the price of 10 monthly payments at $50 a month to escape him. The results that follow such lapses as these indicate the well earned reputation of MOTOR AGE for accuracy.

Consider Safety

DISCUSSIONS of safety measures are in the air everywhere and it is time that some intelligence was injected into this subject. To the layman, the subject of safety suggests that the motorists be forced to drive more slowly, or that each driver be required to obtain a license on the payment of $2 or some like sum that will help some politician keep the wolf from the door without doing any more serious work than asking these two questions:

"Do you drive a motor car?"

"Have you got $2?"

Even the national engineering societies are considering the problems that are presented in the safety situation. They are discussing the meaning of colored lights as used for signals and are beginning to gather data as to why automotive accidents happen. It was at one of these meetings that Alden L. McMurty of the Department of Vehicles of Connecticut, said:

> "It is very easy to place the entire responsibility for automobile accidents on the automobile driver, while, as a matter of fact, the responsibility for conditions which exist rest, not merely on the motorist, but also on the pedestrian and upon the steam and electric railways.
>
> "Pedestrians often cause automobile accidents by ignoring traffic rules. Watchmen are not always at grade crossings when the signs say they should be there; and grade crossing gates are at times, down for considerable periods when trains are not going through. National uniformity in colors for traffic signals is extremely desirable, but if major changes are to be made—as, for example, a change in the color of tail lights for automobiles—it would take at least two years to get such changes into operation because legislation would be required in most states."

The men who are experienced in the use of automotive vehicles must take an interest in these discussions. If they do not, some earnest but misguided coroners and reformers will have the motorist paying a special tax for the privilege of driving his car slower than old Dobbin formerly made the trip. Then what will become of the dealers?

Can You Afford to Be Without— *An Axle Stand?*

THE value of an engine stand to the automotive shop is pretty well known by this time, especially in the better operated shops, but there is room for improving the facilities for disassembling and assembling rear axles.

A rear axle is a rather awkward piece of machinery to handle unless there are means at hand to properly support it so the mechanic can get at the parts easily and with minimum effort. Many shops apparently are content to do axle work on a pair of wood horses, which is obviously better than doing the work on the floor.

The best results are had, however, by using a cast iron stand built solely for axle work. These stands usually are made with a pipe vise to hold the housings and will take axles from any make of car. There always is an abundance of oil or grease coming from a rear axle when it is disassembled and to take care of this most of the axle stands are provided with a drip pan which is located to come just under the differential housing. This makes for a clean floor and improves the appearance of the shop materially.

An axle stand allows a mechanic to fit bushings and sleeves easily, as the parts are held very rigid. A second man is not necessary to "hold on." Much more careful adjustment is possible on the gears and the fittings of parts when the job is well supported and the mechanic can work in a comfortable position. There is little use of placing in a chassis an engine which has been overhauled on a stand and expect it to give the best results in a car, the rear axle of which is poorly assembled and adjusted from lack of proper facilities for handling the work.

Truck Factories Increasing Output

Passenger Car Plants Still Operating at Full Speed

South and Other Farming Sections Promise Good Market When Crops Are Harvested

NEW YORK, June 20.—All passenger car plants are still operating at full speed and truck factories are steadily increasing their output. Many companies, especially those which might be placed in the middle class in volume of production, claim to have on hand sufficient orders to keep them going at the present pace from one to three months. Makers of several of the more popular lines are far behind on deliveries.

Reports from the south and from the centers of the great agricultural districts are all to the effect that much automotive equipment will be purchased by planters and farmers as soon as the harvests are well under way. The south promises to be a particularly good market in the fall. Sales of tractors and other agricultural machinery also are steadily mounting. The leading interest in the low-priced tractor field is unable to keep pace with orders.

The northwest may be taken as typical of these sections. Sales of motor vehicles in May broke all records, but with the beginning of June there was something of a recession in demand. This is expected to continue until the harvests. There is every reason to believe that it then will revert to the level of May.

Indications are that June will be another month in which production will pass the 200,000 mark, but the total promises to be slightly less than in May, when it was 252,000. It is improbable that volume of output can be continued.

Production still is handicapped somewhat by a shortage of the raw materials from which parts are made. This is the result of caution in ordering on the part of manufacturers who are reluctant to accumulate inventories in excess of the orders actually on their books. The industry as a whole still is proceeding cautiously.

Several more mergers, both of truck and passenger car makers, are in the air and formal announcement of some of them probably will be made in the near future. None of the more prominent companies is included in the merger reports.

Numerous producers already are making plans for the introduction of new models in the early fall, but few of them propose radical departures. Most of the changes will be in the nature of refinements. Chief attention in this respect is being given to enclosed models. Demand for enclosed cars is expected to be stronger this fall than it ever has been before because of the sharp price reductions which have brought them more nearly into line with the cost to the consumer of touring cars and roadsters.

Completes 36,000 Miles in His 27th Car

BROOKLYN, June 19.—Charles L. Gilbert, a real estate man of Brooklyn, thinks that for a non-professional driver, and a man not in the automobile business, he probably has had experience with more cars than any other owner. He has been a touring enthusiast for years and has had 27 cars of various makes and styles. He has just completed 36,000 miles in a Velie.

Ohio Automotive Trade Assn. Organizing Local Groups

Columbus, O., June 19—The Ohio Automotive Trade Assn. has been looking after organization work throughout Ohio during May and June with considerable success. Steps are being taken to organize a local association in Zanesville while others will be started soon. When these organizations are completed they will be affiliated with the state association.

The association, in co-operation with the Ohio Automobile Assn. and the Ohio Good Roads Federation, will present a united front to the coming legislature in its program. All of the differences between the three associations have now been ironed out and all legislative matters will be handled by a joint committee of the three associations in order to get the best results with the coming Ohio General Assembly.

INTEREST IN TRUCKS CONTINUES

Pontiac, Mich., June 19—No cessation of buying interest in trucks was indicated at the fourth of the series of agents and salesmen's assemblies being held by the General Motors Truck Company at its plant here, when the men gathered from sales districts of the south and southwest on June 13 and 14. The men all were enthusiastic about the sales prospects, as were those who had previously attended the meetings. Orders continue to arrive in encouraging volume according to Vance Day, sales-manager for the plant.

USED CAR ASSOCIATION DISSOLVES

Madison, Wis., June 19—The Madison Used Car Co., an association of 15 persons who own or operate automobile agencies in this city, filed dissolution papers this week. The company's dissolution follows an investigation by Attorney-General W. J. Morgan into the practices of the association with reference to the anti-trust laws of the state.

National Motorists' Assn. Is Organized at Chicago

200 Delegates from Twelve States Adopt Constitution—Result of Split in A. A. A.

CHICAGO, June 19—The National Motorists' Association was organized here today by about 200 delegates from automobile clubs representing the opposition to the American Automobile Association which developed at the National Convention of the A. A. A. at St. Louis last month. The delegates came from about twelve states, including Ohio, Illinois, Michigan, Iowa, New York, Massachusetts, Indiana, Missouri, Texas, Nebraska, California and Washington.

A constitution setting forth the name of the organization, its principles and purposes and the scheme of organization and operation was adopted by unanimous vote of the delegates. The central offices are to be at Washington, D. C. The purposes include cooperation with state and local automobile associations, promotion of good roads, collection of data of interest to motorists, action on legislation affecting motorists, protection of motorists from excessive and unreasonable charges for materials and services used in connection with motoring, and the uniform marking of roads.

The constitution also provides for supervision over automobile exhibitions and contests, indicating a purpose to promote shows and races. The following classes of membership are provided for: State associations, local clubs in states in which there is no state association affiliated with the national body, individual and sustaining. Individual membership dues are $10 annually; sustaining memberships, $100 annually, and there is a scale of from 15 to 25 cents a member, according to number, for association and club memberships.

Fred H. Caley, president of the Ohio State Automobile Association, was temporary chairman. Among the speakers were Judge Walter D. Meals, of Cleveland, and Richard H. Lee, of Chicago, both of whom have been active in the A. A. A. Both predicted that the new association would precede the A. A. A. Caley announced that he was authorized to affiliate the Ohio association, having about 50,000 members, with the new organization. Many other delegates said they were not officially authorized to affiliate, but were confident their organizations would come in. Committees on credentials, resolutions and nominations were appointed. Judge Meals was unanimously elected president. A board of governors consisting of 30 members was elected.

Automobiles Use 4 Billion Gallons of Gasoline in Year

Average Consumption of Passenger Cars 335 Gallons, Trucks 825 Gallons

WASHINGTON, June 17—The automotive consumption of gasoline last year, according to the Bureau of Mines, was 4,000,000,000 gallons, exclusive of domestic-industrial uses, which was 516,012,979 gallons. It is estimated that passenger cars averaged 335 gallons for the year and motor trucks 825 gallons. The amount used in motorcycles and tractors is not estimated.

The figures show that the consumption of gasoline as a motor fuel has increased from 484,000,000 gallons in 1913 to more than 4,000,000,000 in 1921, while the number of motors in the same period from 1,027,000 cars to approximately 10,500,000.

The figures furnish some interesting comparisons of the growth of the industry since 1899, when the automobile was comparatively unknown. In that year production of gasoline was 280,770,000 gallons, while in 1921 it was 5,153,549,000 gallons. During the same interval exports jumped from 19,102,000 gallons to 33,089,000 gallons, while domestic consumption rose from 261,650,000 gallons to 4,516,013,000 gallons.

POSSIBLE MERGER SEEN

Cleveland, June 17—Although executives of the Hydraulic Pressed Steel Co. will not discuss the matter, financial circles in this city are alive to the fact that there is pending a merger of corporations engaged in the manufacture of automobile frames.

At the plant of the Hydraulic Pressed Steel Co. in this city, the only admission that could be obtained on the subject was that a meeting of representatives of the various companies interested was held in this city on Friday, June 9. Meeting with the managing executives of the Hydraulic company and its lawyers were officers of the Spicer Manufacturing Co., it was reported. The Detroit Pressed Steel Co. is also said to be under consideration as one of the factory units to be included in the deal.

WILMINGTON ASSN. OFFICERS

Wilmington, Dell., June 16—Harry N. Partington has been elected president of the Wilmington Automobile Trade Assn.; Enoch Moore, Jr., vice-president; Clarence E. Unger, treasurer, and E. P. Merrick, secretary.

HUPP GETTING MORE DEALERS

Detroit, June 17—Hupp Motor Car Corp. is encouraging its distributors in all cities to open up their territories to other dealers, in just such numbers as the size of the territory warrants. Though the appointment of the sub-dealers is left to the discretion of the distributor, the company has adopted the policy of seeking the most intensive means of covering its entire territory, that may be employed successfully.

New York has witnessed the opening of another Hupp dealership in the past ten days. The multiplication of its sales outlets is declared by the company to be one of the reasons for the increased demand that Hupp has met this year.

Retail Selling Conditions Improved in Pontiac Field

Pontiac, Mich., June 17—Retail selling conditions on cars in the Pontiac field are vastly improved, according to a concensus of opinion among local dealers. The sale of used and new models has picked up well, so that dealers are not handicapped so badly in taking in old cars as they were last winter. Several dealers reported not a used car on hand at the end of the first week of June.

The Oakland Motor Car Co. has been conducting an intensive campaign in this district, to increase retail sales of their automobiles in the vicinity of the plant itself, and encouraging results are reported by George Alger, Michigan retail sales manager. In Michigan, he said, May was the banner month for retail car sales, showing 100 per cent improvement over April, while business thus far indicates that June will exceed May by 50 per cent.

The Oakland County branch finds farmer trade rapidly developing, according to Alger, who says that not only new but used cars turn rapidly. The county branch on June 9 alone sold five used machines.

CADILLAC'S HIGH DAY

Detroit, June 15—A high mark for one day's output in the production record of the Cadillac Motor Car Co. was reached recently when 150 of type 61 cars were made and shipped in 24 hours. More than half of this number were enclosed bodies. The value of the day's output was over $700,000. The total number of men now employed at the Cadillac plant is approximately 8,000 and additional men are being taken on at the rate of 50 a day.

RICKENBACKER ABANDONS FLIGHT

Omaha, Neb., June 16—"Eddie" Rickenbacker's around-the-country flight came to an abrupt end yesterday when he attempted to hop off from the U. S. aerial mail field here for Denver. The plane took off, but when about 12 feet in the air the engine stalled and the plane crashed to the ground nose first, demolishing the propeller and landing gear. None of the occupants were injured.

TRACTORS SUBSTITUTE FOR COAL

Lovington, Ill., June 17—With the exhaustion of the coal supply here, due to the miners' strike, the electric light and power plant has installed a tractor to drive its generators. The farmers' elevator also is using a tractor for generative power.

8,000 Trucks in Europe Ready For Reimportation Into U. S.

Figures Indicate Dangerous Competition With New Products Unless Graham Resolution Passes

PARIS (France), June 17—(By Cable)—There is a total of approximately 7,000 trucks in France which will be dumped on the American market at prices far under the regular price, if it is found that they can be reconditioned and shipped back to the United States. Of this number approximately 50 per cent are now serviceable and will need no reconditioning.

In addition to the 7000 in France there are 1770 trucks in the hands of dealers in England, according to the British Liquidation and Disposal Board, which still remain to be sold, and which it is expected will be returned to the United States to compete with new trucks.

Because of the pending legislation in congress at Washington, shippers are withholding immediate shipment for fear that the 90 per cent re-import tax might be imposed before the shipments can reach the United States.

The Washington View

Washington, June 15—The announcement that there is a total of approximately 8750 trucks in Europe available for re-import to the United States, it is expected, will effect the passage of the Graham resolution (HJ 183), introduced in congress at the request of automobile dealers, and which will, it is declared, prevent the dumping of war trucks and passenger cars into the United States by imposing a 90 per cent re-import tax on all automotive vehicles returned to this country.

Opinion has been expressed by members of the Senate Finance Committee, who must pass on the measure, that there is no real need for the passage of the Graham anti-dumping bill. The statement was made before the House Committee by the automobile dealers that there were approximately 5000 trucks abroad which could be brought back into this country and sold, even with the return freight added, at considerable under the market, thus demoralizing the United States trade.

Senator McCumber, Chairman of the Senate Finance Committee, last week took up with Secretary Hoover the question of the re-import duty and expressed as his opinion, and that of the Committee, that the tax was not needed, "as it was the opinion of the committee that nothing like 5000 cars were available for re-import."

The figures, which should be received by the Commerce Department in a few days, and which will be transmitted to Congress, it is confidently expected, will show the imperative need for prompt passage of the anti-dumping measure to obviate glutting the local market with trucks.

Would Make 15,000 Cars a Year at Kentucky Co. Plant

Figures Given at Hearing Where It Is Learned Seven Other Firms Are in Proposed Merger

LOUISVILLE, Ky., June 17.—At a hearing in the Federal District Court here last week it was revealed that the Associated Motor Industries, which has been active in the movement to consolidate the Kentucky Wagon Mfg. Co. with a number of other automobile and parts manufacturing concerns, has plans for the production of 15,000 automobiles and 40,000 wagons a year at the Kentucky company's plant. The hearing was in connection with the receivership proceedings which have been instituted against the Kentucky Wagon Mfg. Co. James R. Duffin, attorney for the company, asked that the company be granted until June 26 to file its response to the receivership plea.

At the same time it was learned that the contemplated merger being undertaken by the Associated Motor Industries included the following eight firms: Kentucky Wagon Mfg. Co; National Motor Car & Vehicle Corp. of Indianapolis; Traffic Motor Truck Corp. of St. Louis; Recording & Computing Machine Co. of Dayton; Covert Gear Co. of Lockport, N. Y.; Jackson Motor Corp. of Jackson, Mich.; Saginaw Sheet Metal Works of Saginaw, Mich., and the M. & T. Corp. of Boston. The Associated Motor Industries was incorporated in September, 1921, in Delaware.

It was learned that the new company, which probably will have a name other than that of the Associated Motor Industries, proposes to manufacture a line of passenger automobiles under the trade name "National" and to manufacture a line of trucks under the trade name "Traffic Truck."

It was also learned that there is in contemplation the issuance of bonds, the amount to be probably $4,500,000, to provide immediate working capital and to carry out the plans of the new company.

Chicago, June 19.—It was learned here that plans for the financing of the new automobile merger, negotiations for which have been conducted by the Associated Motor Industries, have been approved by the Union Trust Co. It is understood that when the details of the merger are announced a new name will be substituted for the Associated Motor Industries.

COATS CO. MOVES OFFICES

Chicago, June 16—The Coats Steam Car Co. has moved its general sales offices, which were established here about three months ago, to Columbus, O., where the company recently acquired a factory.

Winner of Yosemite Sweepstakes Prize

THE Oakland car which won the grand sweepstakes prize in the recent Los Angeles-Yosemite Economy contest was a model 6-44 phaeton. This car's ton mileage for the 360-mile run was 49.37. The ton mileage is obtained by dividing the gross weight of the car in tons by 360, the distance traveled, and then dividing by the number of gallons of gasoline consumed. The car made an average of 29,38 miles to the gallon of gasoline. This car showed no appreciable consumption of oil and only two pints of water were used. It also won the cup for the class in which it was entered.

The two prizes were awarded to the driver by Mrs. D. A. Curry at Camp Curry in the presence of officials of the American Automobile Association, under whose auspices the contest was conducted.

June Seems to Be Best Month for Indianapolis Factories

Marmon, Lafayette, National, Cole and Others Reaching New High Marks

INDIANAPOLIS, June 19—Marmon, National and LaFayette factories are feeling strong stimulous from recent factory announcements and each is making a new record this month, with appearance of business keeping up strong for next month. Marmon went into June 500 orders behind and May records in retail sales for the entire country are claimed to have been the highest ever by this organization, though some production records of 1920 surpassed the May figures in factory shipments. Shipments this month exceed last month's figures, although slight material shortages may prohibit further record breaking.

National's recent price cut that was announced in advertisements of a week ago has brought a big business to the veteran maker of this city, and this week's shipping records place it ahead of any week for some years. Factory production is being increased progressively. An increased force of men was put to work this week. Next week will see another increase, and if the orders continue to arrive at anywhere the present rate this process will go on week after week, until the plant reaches capacity. Although the price cut went into effect as of June first there was not time when the decision was reached to cover the country in the advertising announcements during the first week. Accordingly the announcements with the exception of two cities were delayed until a week later. The instant response to this new price scale seems to portend a flourishing business for this veteran vehicle manufacturer of the city, though George Dickson, president of the company will make haste conservatively in swinging into maximum production. By increasing the force slowly there will be no wrench of factory systems and the standards of the plant will be maintained at all times.

Lafayette Motors, recently reorganized, is now turning out more cars than at any time in its history. Six cars a day are being manufactured and shipped, and the inflow of orders seems to be steady. June will certainly be up to May, and July looks as good at the present time. There seems to be confirmation of the belief that the plant will continue in Indianapolis in spite of the reorganization.

Cole is making steady progress with May, the best month of the year, and with June running as well. H. C. S. keeps at a normal pace established about three months ago when its price cut went into effect.

Shortage of Some Lines of Cars in Central Illinois

Crop Prospects Indicate Good Fall Business in the Rural Communities

BLOOMINGTON, ILL., June 20—Predictions made early in the spring that there was likelihood of a shortage of cars by midsummer and which were treated with more or less skepticism by the buying public, bid fair to be realized, although perhaps in not every line. A number of the central Illinois dealers are complaining about unfilled orders and the inability to keep deliveries paced with sales. The Thayer Morrow Co., of this city, which has the Dodge Bros. distribution in McLean, Kankakee and several contiguous counties, reports that the various agencies report a total of 91 orders on hand June 10 which can not be filled until later in the summer.

Bloomington is a railroad and agricultural center. The Chicago and Alton railway shops are located here and this city is the divisional point of the same road, 3,000 employes residing here. The company has operated the shops on full time and with undiminished force during the entire year and this prosperous condition is reflected in the sales of cars to railroad men. The conditions on the farm are also bright. After a late start in planting, crops are coming along satisfactorily and the farmers are in a buying mood. Salesmen are commencing to line up the rural trade once more and prospects will be kept in hand until the fall sale of grain is made, when it is expected that many cars will be sold and also a number of trucks and tractors.

Central Illinois has seldom had a crop failure. The yield is always large. The trouble for the past two seasons has been the abnormally low prices for farm products. This condition is slowly adjusting itself and the steady improvement means a proportionate improvement in the automotive business among the farmer patrons. In the meantime, truck and tractor salesmen, while keeping a watchful eye on rural prospects, are devoting most of their energies to highway commissioners and hard road contractors. There is a steady demand for these machines in the grading of the dirt roads and the concrete surfacing of the bond issue trunk lines.

COLUMBIA SALES GROWING

Detroit, June 17.—Stockholders of the Columbia Motor Car Co. were informed at their annual meeting by President J. G. Bayerline that the company now has on hand orders for 23,700 light sixes for delivery up to Jan. 1, 1923. This makes a total of $25,000,000 worth of business pending for the remainder of the year. Directors were re-elected and they subsequently re-elected the old officers with the addition of George J. Martin as assistant secretary and treasurer.

The books of the company indicate that June will be its largest month and officials declare that July will be 50 per cent better. Stockholders expressed their approval of the large production plans outlined. It was announced at the meeting that Columbia now has 102 distributors in the United States and Canada, exclusive of foreign connections and 1,015 dealers.

Propose National Milk Distribution by Trucks

Washington, June 17—Organized milk producers of the country today issued an ultimatum to the railroads to reduce freight rates or compete against a national motor transport. A delegation of the National Milk Producers Federation and representatives of the American Farm Bureau Federation asked the Interstate Commerce Commission for a hearing before final steps were taken for the establishment of a motorized system of distribution.

INDUSTRIAL MOTORS ELECTION

New York, June 16.—Organization of the Industrial Motors Corp., a combination of the Selden Truck Corp. and the Atlas Truck Corp., has been completed. The new corporation is understood to be negotiating for the acquisition of several other truck and accessory companies.

John J. Watson, Jr., president of the Lee Tire & Rubber Co., and chairman of the board of the Martin Parry Corp., has been elected president of Industrial Motors. The vice-presidents are: Geo. C. Gordon, Robert H. Salmons, Allan R. Cosgrove and James R. Floyd. Henry Hopkins, Jr., an attorney, has been elected secretary and treasurer.

MARYLAND GASOLINE TAX

Baltimore, June 20—The State of Maryland has added to the high cost of gasoline by imposing a tax of one cent a gallon on gasoline used in motor vehicles. The revenue will be used to reduce a long-standing deficit of $1,000,000 in the maintenance fund of the State Roads Commission. The tax expires on Dec. 31, 1923, but on the day another tax of two cents a gallon becomes effective, the proceeds to be applied to a reduction in the fees for the registration of automobiles.

THIS CLOCK TURNS ON LIGHTS

Milwaukee, Wis., June 19—John F. Schreiber, veteran Milwaukee automobile man, has invented a new automobile dash clock, which when set at an appointed hour, automatically turns the light switch and lights the number of lamps indicated on the dial. The functioning of the clock as a timepiece is never interfered with, neither is the lighting switch as originally installed on the car hampered by the new device which has been patented.

Atlanta Dealers Business Continues to Improve

Registration of Ownership Shows Increase of Over 200 Per Cent

ATLANTA, GA., June 20—Sales in the Atlanta territory continue to show some improvement from week to week, a majority of the dealers advise, though as a whole business is not at a point that could be termed satisfactory. The outlook, however, is steadily improving, due to advancing cotton prices, and by the latter part of the year the trade is anticipating that sales will again be running along on about a normal basis as compared with the business of pre-war times.

Registrations in Atlanta alone for the week ending Saturday, June 10, were slightly in excess of 175, which indicates a very material improvement as compared with the same period last year when each week's average was around only 50. These registrations include new and used passenger cars and trucks, and inspection of them shows that a large majority of the sales being made are of medium and lower priced cars, Ford sales well in the lead. Ford business, in fact, the Atlanta dealers state, is considerably above normal and has been holding up well for the past three months.

Registration figures throughout the state show that in the counties where the larger cities are located, such as Savannah, Macon, Atlanta and Brunswick, sales are proportionately greater than they are in the smaller communities. Business among the smaller dealers is at a very low ebb and there is little promise of improvement for some months due to the poor financial condition of the southeastern farmers.

Accessory and tire sales are considerably better than at this time last year, while service station business is probably 100 per cent improved.

BAKELITE CORPORATION FORMED

New York, June 17 — The Bakelite Corp. has taken over the General Bakelite Co., the Condensite Company of America and the Redmanol Chemical Products Co. The merger is the result of a suit for infringement of the Bakelite patents brought against the General Insulate Co. of Brooklyn, one of the customers of the Redmanol company. This suit resulted in a victory for the Bakelite company when a decree in the United States district court broadly sustaining the Bakelite patents covering the molding of phenolic condensation products by heat and pressure and the use of fibrous bodies in such products.

Dr. L. H. Baekeland is president of the new Bakelite corporation. The vice-presidents are Philip Schleussner, A. Karpen and Kirk Brown. Brown is general manager. The offices of the corporation are at 8 West 40th street, New York.

Greatly Increased Demand for Tires in Middle West

President of Midwest Rubber Assn. Says Recent Reductions in Price Not Justified

CHICAGO, June 17—W. W. Wuchter, president of the Midwest Rubber Manufacturers' Assn., in a talk at the monthly meeting of the association, discussed the recent action of some manufacturers in reducing prices which he said was not justified in view of increasing costs of production and the fact that most of the companies had been losing money for two years. It was his opinion that this action was deliberately undertaken for the purpose of driving smaller competitors out of business.

Wuchter said it was his opinion that tire business for the rest of this year will be done on price altogether and he advised the members of the association to adopt all possible manufacturing and marketing economies.

Most of the companies affiliated with the Midwest association are producing tires and tubes on a comparatively small though increasing scale. The largest daily production of casings that was reported at today's meeting was 900. One manufacturer was making 700, another 600, and other reports ran from 160 to 500. The products of these factories are marketed largely within their respective trading areas.

A greatly increased demand for tires in the Missisippi Valley in 30 days or six weeks from now was predicted by Sidney J. Roy of the Hannibal Rubber Co., Hannibal, Mo. Roy said the farmers of this section are now very busy with their crops, but that within a month a large wheat crop will have been harvested and that the farmers then will begin to buy.

The scheduled speaker at the meeting was Frank T. Bentley, traffic manager of the Illinois Steel and Universal Portland Cement Co., whose subject was "Transportation." He predicted that by next fall there will be a shortage of freight cars and that as a consequence another great impetus will be given to motor truck transportation. It was his opinion that truck transportation is only in its infancy.

CALIFORNIA DEALERS TO MEET

Oakland, Cal., June 19—The southern division of the California Automobile Trade Assn. will hold its annual convention at Pasadena, about nine miles from Los Angeles, June 26-27. A number of members of the northern division, which has its headquarters in Oakland, will attend, and reports from the south are that more than 80 per cent of the southern membership will be present at the Pasadena meeting. P. E. Chamberlain, of St. Louis, will be the principal speaker, discussing the flat-rate plan of repairs on cars. Robert W. Martland, secretary-manager of the state association, will present his semi-annual report, and George Heberfelde, of Bakersfield, president of the association, will be in the chair throughout the convention.

The first day is to be devoted to meetings of the various crafts of the association. Battery, tire, repair, service, and garage men and dealers will meet separately at the call of their respective chairmen. The second day will be given over to a general meeting, at which the chairmen of the different crafts and committees will report to the whole body.

GOOD ROADS EXHIBITS

Washington, June 17, 1922.—Educational exhibits, depicting good roads, were definitely decided upon at the bimonthly meeting of the Highway and Highway Transport Education Committee. The committee authorized immediate work on preparation of three exhibits which will be sent to more than 100 universities throughout the United States teaching the value of good roads and highway transportation.

The three exhibits will include one of automobile engines, to be furnished by the National Automobile Chamber of Commerce; the second, good roads, to be prepared by the Department of Agriculture, Bureau of Roads, and the third, rubbers, being principally tires, to be furnished by the rubber associations.

MUNICIPAL SERVICE MOTORIZED

Chicago, June 17.—Further motorization of the municipal service of Chicago is provided for by the city council finance committee which has approved an expenditure of $31,958 for eight tractors and $101,590 for 81 trailers to be used in hauling city refuse. The plan is to use horses to draw the trailers through alleys to be loaded with refuse and after the trailers are loaded they will be pulled in trains of three by tractors to the dumps. If the experiment is a success it is expected that more than $2,000,000 will be expended in motorizing the entire service.

PARKER AIR-COOLED CAR

Montreal, June 19—The Parker Motor Car Co., Ltd., makes the announcement that it is developing a new small air-cooled car which will be a running mate for the Parker Six. This automobile, which has 112-inch wheel base, has in actual practice been driven 18,000 miles on a set of fabric tires, with an average gas consumption of 35 miles to the gallon and 1,200 miles on a gallon of oil. This car will, the company expects, be put out to the public at from $659 to $750.

NEW FIELD FOR LIGHT PLANTS

Bloomington, Ill., June 20—A farm lighting plant is being used by the J. C. Vanderbloom Construction Co. to enable it to operate a night shift in the construction of the Grant Highway in northern Illinois.

Automotive Trade Still On Up Grade in California

Sales Increase for First Six Months Will Be About 55 Per Cent Above Last Year

SAN FRANCISCO, June 19—Conditions in the automotive industry in central and northern California continue steadily on the up grade, on which they started the latter half of last December. Sales for the first quarter of 1922 for the entire state increased 43 per cent over those of the first quarter of 1921, and in northern and central California the increase was approximately 47 per cent. Indications from actual sales are that the record for the first six months of this year, ending with June 30, will be from 55 to 60 per cent, if not more, better than they were for the first six months of 1921.

As the dealers have prospered, so have the active and well-equipped garage and maintenance men. With dealers going at a high-power average, it is a certainty that the repair business will boom as well. There were, for example, 12,923 new cars put on the road in California in March alone, and nearly as many more in April, and the matter of getting the regular business of the owners of these cars now rests on the kind of work done by the garage man and the kind of equipment he has with which to do it.

In Oakland 82 automobiles of one make were sold by one firm in May. This is the largest May business in the history of the company which makes this automobile, and is an increase of 60.4 per cent over the May business in 1921. While this is not an advertisement, it may be permitted to say that the car was the Studebaker and the dealer the Weaver-Wells Co. In connection with the general expansion which is going on in the automotive industry in this section, the Urey-Noteware Co., which established an automobile distributing house in Oakland recently, with the Leach car, also has taken over the distribution of the H. C. S. in the cities on the mainland or east shore of San Francisco bay. The Leach is a California-built car, being made at Los Angeles, and is showing in steadily increasing numbers on the highways of the state.

FORD WOULD MAKE ALUMINUM

Washington, June 16.—At a recent hearing before the Senate Committee on Agriculture and Forestry, William B. Mayo, chief engineer for Henry Ford, testified that if Ford succeeded in getting control of Muscle Shoals on the terms he has proposed to Congress he would devote a great part of the power generated there to the manufacture of electric furnace steels and aluminums. It appeared from this testimony that the manufacture of fertilizers as proposed by Ford would really be incidental to the production of metals which could be used in the manufacture of automobiles.

Cash from the Sock Pays for Automobiles in Northwest

Minneapolis Distributors Enjoying Unusual Business Find People Have the Money

MINNEAPOLIS, June 20—Automobile dealers in the northwest have been wondering where all the money came from that participated in the recent raid on automobile stocks. They have discovered that it has been dug out of socks, tin cans, kitchen stoves, and other hiding places where people who were afraid of banks, of the business future, of themselves and everything else have been keeping it. The sun of prosperity having risen and begun to dispel the clouds of gloom, these people have begun to come to themselves and are holding private resurrections of cash.

One distributor who has been touring rural districts said this money actually was mouldy that was brought in by some of his country dealers to pay for cars. However, except where distributing agencies and factory corporations have been financing dealers, there is still a lack of money to pay for small car shipments from distributors. The bankers either haven't the money or won't let loose of it.

Spring Spurt in Business

This spring spurt in business which has developed a shortage of cars with dealers and their distributors has come earlier than usual, so that many report May as a record month. In fact, Chevrolet distributor reports the best month the branch ever had. By the same token this business has receded about a month earlier than usual, and another spurt is not expected until the bumper crop on the way is assured, and perhaps partially liquidated.

It has been an enclosed car season and dealers who have not expected this jump in business, particularly in the enclosed car, are bemoaning shortages. One company, the Chevrolet, has had seven train loads of an average of 150 motor cars to the train arrive in a month. On the other hand, the Pence Automobile Co. considers the trainload no longer a novelty and is letting its train of component cars lie on sidings on the Minneapolis Southern electric road, while shipments are being brought in every which way as fast as the cars are ready, many being driven eastward, as usual, by local tourists who prefer to take delivery at the factory for the summer jaunt. These cars won't get back until fall, when the owners return, but they are nevertheless considered deliveries.

On June 10 this recession in business had been noted for some 10 days, and schedules made from the daily registrations in Minneapolis for state licenses to drive cars seem to show that dealers who had been forehanded in anticipating the rush in the face of all sorts of gloomy talk, are doing the big business.

The Buick people report that the cry for cars is as loud as ever. A bumper crop is in sight with few bad spots. The firm's traveling men report that there are wonderful prospects for the sale of cars later. They, too, discover the people are digging money out of their socks to buy cars.

However, there seem to be few sales to farmers in the truck line. What sales there are are mainly replacements. Equipment of wholesale houses has been allowed to drop down and now must be put in condition or replaced. Other firms do not find business in trucks very good.

An illustration of local retail sales in motor cars by one firm will have the effect of a birdseye view of the general condition in this line, and the variety of demand there is. In one day these sales were distributed as follows: Business men, 3; salesmen, 2; merchants, 2; public school teacher, physician, oil company, music teacher, farmer, chef and bookkeeper, one each.

General business conditions are indicated in the demand for cars reported by the Ford assembling plant. June sales are to total in Minneapolis territory, cars, trucks and tractors, $4,500,000 for 8,840 vehicles, of which 8,190 will be assembled at the local plant. The force is now 750 men, as against 140 Jan. 1. The capacity is 315 cars every day of eight hours, beginning June 1. The April distribution was 4,806 cars as against the best previous month, which was 4,573 in 1919. May's total was 6,240 machines. The June record for Fordsons is expected tto be 750, as against 433 in April. The company expects to sell in the Twin Cities 2,500 vehicles a month through the summer. In May it was past 2,000 and in April the sales totaled 1,836 cars and trucks.

Gives Up Locomotives for Gasoline Cars

GLOVERSVILLE, N. Y., June 17—Announcement is made by the Fonda, Johnstown & Gloversville Railroad, which connects the New York Central lines with the southern part of the Adirondack region, that on July 1 it will discontinue the use of passenger locomotives on its steam division and substitute gasoline railroad cars for them.

TALKS TO DEALERS

Fort Wayne, Ind., June 19—P. E. Chamberlain, noted automobile authority, has been engaged by the Fort Wayne Auto Trades Assn. to give a series of four talks to local automobile dealers and to all other persons who care to come to the meetings. The idea in staging these talks is that they will help considerably in bettering local automobile conditions for owners and garages.

Large Tire Surplus Likely, Says Harvey S. Firestone

Warns Manufacturers That Present Rate of Production is Not Justified by Demand

AKRON, O., June 19—Despite the fact that the current demand for automobile tires is unprecedented in the history of the automotive industry, tire companies in Akron have surged ahead to production records which forebode another tire surplus and which indicate an actual present over production, according to President Harvey S. Firestone of the Firestone Tire & Rubber Co.

"Our information shows that there is a large over production in tires now in many sizes and types. In fact, the demand all along the line has hardly kept pace with production, and, as a consequence, a surplus has been piling up," states Firestone in reviewing the present tire situation.

"It is expected that the usual increase in trade sales during the coming summer months will absorb this surplus, and I hope this will enable the rubber industry to maintain its present production schedule late into the autumn months.

"We have no plans at present for a Firestone increase in production and therefore we are not hiring additional help. The demand for original equipment from automobile manufacturers is the chief cause of the present high point of tire production in Akron. Whether this demand will be maintained is uncertain. As far as I can see, there is nothing in sight to warrant the belief that the tire industry will go much beyond its present production this year."

Firestone's warning comes in the face of one of the greatest booms the tire industry has known, not even excepting the then unprecedented spurt of early 1920. Nearly every tire company in the city is producing to its limit and is crying for more men, advertising for them in other cities, and boosting wages as an added attraction.

Tire output has been over 85,000 a day now for more than six weeks, and is steadily increasing. Firestone is running between 24,000 and 25,000 a day. Goodyear has climbed to 26,000 a day. Unofficially, it is said that Goodyear is considering a temporary production of nearly 30,000 a day, provided men are available, in order to catch up with orders and to replenish its exhausted finished goods inventory.

There are several manufacturers, however, who agree with Firestone that the possibilities of another huge tire surplus are increasing. They say they expect a sharp let-up in orders from automobile manufacturers soon after the first of July and some are also anticipating a seasonal slump in consumer sales in July and August.

Fords Take Over Lincoln Management; Lelands Quit

Cause of Break Not Made Public—No New Executives Expected to Step In

DETROIT, June 19—According to sources close to Henry Ford, the elimination of the Lelands, Henry M. and Wilfred C., from control of the Lincoln Motor Co., will not mean that other figures well known in the industry will be chosen to guide the destinies of the Lincoln company, but rather that the administration of its affairs will be assimilated by the different executives of the Ford organization.

Shortly before the notice that the Lelands had gone was issued, the purchasing department of the Lincoln company was moved to the Ford Highland Park plant, and the sales department of Ford was moved to the Lincoln plant. This had the effect of bringing all purchases under the supervision of F. H. Diehl, the Ford buyer, and brought sales under the supervision of W. A. Ryan, Ford sales chief.

Recently the manufacturing and machining of several parts for the Lincoln car has been transferred to Ford factories where better facilities made it possible to increase the production on Lincoln cars. This manufacturing will be extended until the Lincoln company is placed in a position where it will enjoy all the high production facilities of the Ford plant. All Lincoln production is under the supervision of Ford engineers and production experts.

The cause of the break between the Lelands and the Fords has been commonly accepted as incompatibility on manufacturing policies, but men close to Ford say this has been relatively unimportant in bringing about the final breach. It is expected that developments will occur in the next few weeks which will bring the cause of the break into the open, but for the present there appears to be an agreement between the two families to make no statement on the situation.

The first intimation that there was to be a severance of relations came from a source close to both families, and apparently it was intended that the actual severance should become public without any disclosure of the facts. Henry M. Leland at his home Monday night, asked if there was to be a dissolution, said evasively that something along that line might be expected within 24 hours. He added that no matter what happened, he would be at peace with the world.

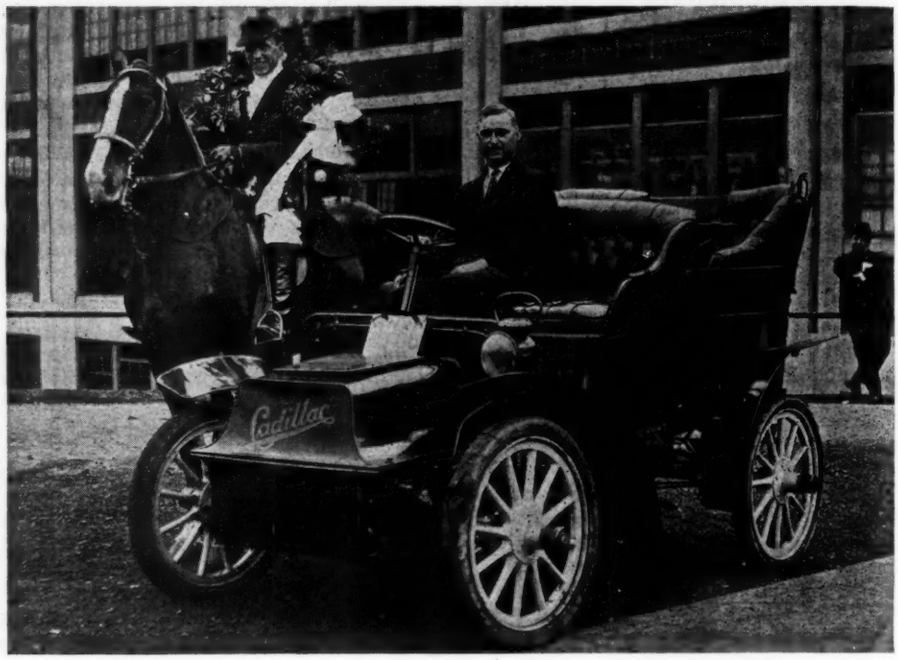
After that there was a denial of all interviewers by both the Lelands and Henry and Edsel Ford. It was reported that the Lelands were out of the city at a conference. Whether this was in Washington on matters pertaining to the government suit against the former Lincoln company for recovery of alleged excess war profits was not ascertainable.

A statement was issued Tuesday by Harold H. Emmons, attorney, who acted for Ford in the purchase of the Lincoln plant, and who was also personal counsel for the Lelands and had been counsel for the former Lincoln company. He said that owing to the large demand for Lincoln cars since the Ford purchase in February, it had been found necessary to make a complete change in factory administration, and that hereafter the Ford organization would assume charge. Emmons said he issued the statement as "an attorney in Lincoln affairs."

BUYS ANOTHER AUTO-LITE PLANT

Poughkeepsie, N. Y., June 15—The factory in this city of the Electric Auto-Lite Corp., which was formerly the Fiat assembling plant, was bid in at receiver's sale yesterday by C. O. Miniger of Toledo for $300,000. Miniger, who already has bid in the Auto-Lite plants at Toledo and Fostoria, said he expected to open the local plant in the near future.

Horse Wins Race with Dealer's Ancient Cadillac



BOSTON, June 17.—A race between a beautiful young horse and an ancient Cadillac of the "one-lung" variety attracted a great deal of attention here the other day. The contest was arranged by Albion L. Danforth, president of the Boston Cadillac Co. Danforth had offered the horse as a prize to the dealer making the best sales record in the New England territory. A condition of the test was that the winner would have to ride the horse in a race with the old Cadillac.

John H. Bates, Cadillac dealer of Woburn, won the sales contest. He also showed he was a good horseman. Clad in a regulation jockey suit of red coat and white breeches, he mounted the horse and rode in the race down Commonwealth avenue, one of the busiest streets in the city. The horse won by a good margin.

After the race a dinner was held at the Kenmore Hotel at which prizes of the General Motors stock were awarded to salesmen who made the best records in retail sales. These prizes were won by Harold D. Bornstein, Edward Fitz-Henry and Frank D. Bancroft in the new car division and by W. L. Sheppard, Wilbur L. Keith and L. M. Severance in the used car division.

To Study Relative Value of Tractor and Horse on Farm

Washington, June 21—A comprehensive survey of the relative cost of tractors as compared with horse power for use on farms will be undertaken by the Department of Agriculture, in order to determine definitely the relative value of tractors on farms.

CANADIAN TAX INTERPRETED

Ottawa, Ont., June 20.—The new five and ten per cent excise taxes on automobiles made in or imported into Canada have been interpreted as follows: The five per cent tax applies on all automobiles up to the cost of $1200 and for cars costing more than that the ten per cent tax is levied on the balance.

DEATH OF WM. G. GRIEB

New York, June 15—William G. Grieb, formerly president and one of the founders of the Ajax Rubber Co., died yesterday at his home at Scarsdale. He retired as head of the Ajax company about two years ago but continued as a director.

IN THE RETAIL FIELD

Sharmon Automobile Co., of Denver, has taken over the distribution of the Dort cars in Colorado, Wyoming, and New Mexico.

L. J. Davey of Des Moines, Ia., has secured the distribution of the Marmon cars in Des Moines and central Iowa.

Craig-Baker, Inc., Denver distributors of the Dodge cars, have leased the building formerly occupied by the Powell-Kennedy Motor Co., and will use it exclusively for the sale of used cars.

George Means of Des Moines, Ia., has purchased the interest of C. W. Kucker in the Means-Kucker Automobile Co. The firm will now be known as the Means Chevrolet Sales Co. Kucker will go back with the Chevrolet Motor Co. and will probably have charge of one of the eastern branches.

United Tire Stores Co. of South Bend, which operates a chain of 433 stores throughout Illinois, Indiana and Ohio, has opened a new store at 1311 South Calhoun street, Fort Wayne. J. C. Belot has been made manager of the store.

Morton-Swalwell Motor Co. is the newest automobile concern in Dallas. It is composed of E. W. Morton, wealthy banker, flour miller, hotel man and business man as president, and C. E. Swalwell, owner of the Jackson Street Garage and for years engaged in the automobile business, as vice-president and general manager. The firm has taken over the Maxwell and Chalmers lines in this territory. The company will occupy the three-story building just vacated by Tennison and Blair and an intensive selling campaign will be inaugurated, it is said, not only in Dallas, but throughout the territory included in the franchise.

Dollar Tires Stores Co. has opened a local branch at 219 West Eleventh street, Wilmington, Del. The company, which has been in existence for some time, has a chain of stores in Pennsylvania, New York and New Jersey, but this is the first one in Delaware.

Des Moines Storage Battery Co. has taken over the distribution of Westinghouse batteries for 73 counties in Iowa.

White Auto Livery Co. has been sold to the Lake City Auto Co., the latter taking possession the first of the month. Boris Levitan of Mt. Horeb, Wis., is the principal stockholder of the new company. A. C. White, retiring owner, who declares the consideration of the sale was $60,000, announces his intention of raising thoroughbred saddle horses.

Diestler Tire Co., Kenosha, Wis., has filed articles of incorporation with a capital of $24,990. Incorporators are H. Diestler and V. Diestler of Kenosha.

Van Dorn Sales Co., 70 South Fourth St., Columbus, Ohio, in addition to being central Ohio distributor for the Grant, Columbia Six and Lexington cars, has taken on the Duesenberg line.

Lancaster Tire and Rubber Co., Columbus, Ohio, has taken a lease on the building on North Fourth St., formerly occupied by the Columbus branch of the Goodyear Co., and will occupy it as the Columbus branch.

UNIFORM TOWING CHARGES

San Francisco, Cal., June 19—Uniform towing service charges are assured to the 30,000 members of the California State Automobile Assn. during 1922, following the action of a meeting of representatives of the official garages of the association in San Francisco, where the following schedule of charges was agreed upon for the year:

Charge for towing car and equipment, including driver, per hour, $4; from 6 p. m. to 8 p. m., and Sundays and holidays, per hour, $5; minimum charge for towing car and driver, $2; minimum charge from 6 p. m. to 8 a. m and Sundays and holidays, $2.50; additional men on any job to be charged for at regular shop time.

In addition to agreeing to this regular schedule of rates, the garages agreed to install and maintain sanitary rest room facilities. The association now maintains free tow service for its own members and for those of the Automobile Club of Southern California over Chowchilla mountain on the Wawona road into the Yosemite, and also on the Big Oak Flat grade.

PAN-AMERICAN ASSETS SOLD

Decatur, Ill., June 16—All assets of the defunct Pan-American Motors Corp. were sold here at public auction on June 8, following an order of the circuit court. There were 300 bidders, representing firms of Chicago, St. Louis, Indianapolis and other cities. Five Herschell-Spillman engines brought $70 each.

Fifty-one sets of wire wheels, five wheels to a set, were disposed of at $18 a set. Two hundred Westinghouse starting motors were sold at $2 each. Fans, foot rails, jacks, brass hubs, pet cocks, fittings, brackets, and dozens of other motor car parts were sold by the dozen or 100. The assets were estimated to be worth $100,000, but at public sale they did not bring more than one fifth of this sum, divided into 700 lots.

The American Motor Parts Company, Indianapolis, purchased many of the service parts and will utilize them in a service station for Pan-American cars which will be maintained in Decatur. In addition to the motor car parts and accessories, the office fixtures, machinery and shop equipment, tools, lumber and paint were also sold.

MAINTENANCE STATION OPENED

Newark, N. J., June 17—The Autocar Co. has opened its new factory branch building in this city. It is one of the largest maintenance stations of its kind in the country with 77,000 feet of floor space on the street level. In addition to sales and service facilities, it will provide warehousing space and a reconditioning department for the entire Greater New York district. The new building, which is located on Frelinghuysen avenue, covers a city block with entrances on four streets.

DOBLE CAR NEXT YEAR

San Francisco, Cal., June 19—Doble Steam Motors, Inc., of this city, announces that it has virtually completed designs for a small steam car to sell for approximately $2,000, and to be put on the market the first of next year. The company also announced that it has obtained the site for a manufacturing plant at Atascadero, down the coast toward Santa Barbara, and that work of construction of a factory to cost approximately $2,000,000 will be commenced before the end of June.

NATIONAL COUPE IS $3725

A transposition of figures in MOTOR AGE June 8 caused the price of the National coupe to be given at $7325. The correct price is $3725.

Uniform Truck Laws Urged By Motor Transport Assn.

Measure Advocated in California to Regulate Loads and Taxing for Highway Support

SAN FRANCISCO, June 21—Uniform motor vehicle laws, providing for the operation of capacity loads on trucks, general promotion of motor truck and motor stage traffic, and the safeguarding and preservation of the highways, will be sought through an initiative measure on the ballot at the November general election by the California Motor Transport Assn., of which Fred Mott, of Fresno, is secretary. Mott has just completed a tour of the state collecting data on the operations of motor trucks and buses, conditions of roads and effect of motor traffic on the paved highways. Following the presentation of the results of his survey by Mott to the organization, the California Motor Transport Assn. adopted a platform which is to form the basis, either of an entirely new law, or of amendments to the present Motor Vehicle Act.

This platform is summarized by Mott as follows:

1—A uniform state vehicle law controlling weight, tire and other operating conditions, as well as uniform tax and the classification of existing highways throughout the state.

2—Extension of police powers to enforce such a law to the California State Highway Commission and to all those charged with the maintenance of roads.

3—That the weight limit of truck and load for four-wheeled vehicles be 24,000 pounds; for six-wheeled vehicles with three axles, 32,000 pounds; and for truck, four-wheeled trailer and loads, total gross weight of 42,000 pounds.

4—That the license, or tax, on motor trucks be increased not to exceed 100 per cent of the present amount, in lieu of any other motor vehicle tax, and that those operating as common carriers and enjoying a special privilege, should pay an increased tax of not to exceed 100 per cent over and above this amount, together with an increased tax on passenger motor vehicles of not to exceed 100 per cent.

5—That measures for public safety, such as proper lighting, signaling devices and connections for trailers be incorporated in this law.

6—That the penalty include a clause making a jail sentence obligatory, in the case of habitual offender.

GOODYEAR ABSORBS WAR TAX

New York, June 18—Goodyear Tire & Rubber Co. announces a reduction of 5 per cent on tires to its dealers. While prices heretofore will be quoted to the consumer at net, the dealer will continue to pay the old 5 per cent war tax, but this will be offset by the reduction of that amount allowed by the company. This means virtually that the company is absorbing the tax.

BUSINESS NOTES

Willys-Overland, Inc., of Toledo, Ohio, has deeded to the Willys-Overland Branches, Inc., of Wilmington, Del., its large building in Springfield, Mass., valued at about $350,000. The Springfield business has been conducted for several months past as a sub-branch of the company's Boston branch.

Parsons-Reynolds Co., Springfield, Mass., has sold its real estate to William R. Parsons, one of the heads of the concern, which thereby becomes tenant instead of owner. No other changes in the business are involved.

Genden Bros. have opened in Springfield, Mass., a store for the sale of gears, axle shafts, springs, etc.

Smile Tire Exchange of Springfield, Mass., has opened a second store for the sale of tires, gasoline, oil, etc., and for the vulcanizing of tires.

Bachman Motor Co., distributors of the Dort line in Wisconsin and upper Michigan, has opened its new salesroom and maintenance station at Van Buren and Mason street, Milwaukee.

B. V. Auto Tire and Supply Co., Milwaukee, Wis., has been appointed factory distributors for Latex tires. These tires are made in Fond du Lac by the Latex Tire and Rubber Co. in cord and fabric types.

Republic Truck Corp. of Detroit has opened a direct factory branch at 2444 Lisbon avenue, Milwaukee, Wis., and has appointed W. F. McCarthy as branch manager in charge of this territory.

Central Garage and Implement Co., Plymouth, Wis., is redecorating and rearranging its salesroom and display windows. A new office and display room are under construction, erected as an addition to the company's present quarters in the old postoffice building.

Edison Tire Agency of Baraboo, Wis., has recently been established in the Kasiskas Harness Shop.

Marquette Auto Sales and Garage is the name of a new garage and maintenance station, opened by Edward A. Solbrig at 3047 W. 63rd street, Chicago. Solbrig has not as yet decided what car he will handle but will carry a complete line of accessories and tires.

Winchester, Ill., Implement and Power Farming Co. has been organized and will handle tractors and other farm machinery. Capital stock has been fixed at $25,000. The incorporators include George A. Moredock, Chicago; J. P. Loveless, Cisco; A. W. Parks, Springfield; R. A. Hall, Springfield, and Randolph Little, Winchester.

Court Garage Co., Pekin, Ill., has been formed and articles of incorporation issued. Capital stock has been fixed at $7500. The promoters include A. E. Severe, G. W. Fluegel, and Henry Stockert. The company will handle automobiles, trucks and tractors and also do a general garage, service, repair and storage business.

Alameda County (Calif.) Automobile Trade Assn. held its annual picnic at Ramona Park, on the state highway between Danville and San Ramona, on June 11. Motor buses, loaned for the day, carried the members, and Jack Bowers was chairman of the affair.

Black & Decker Mfg. Co., builders of portable electric tools, announce the establishment of a new Detroit office in the General Motors Building. C. G. Odell, assistant to president, will use this office as his headquarters.

Carbureter Specialties Corp., 2317 Michigan Ave., Chicago, has been incorporated. Capital, 400 shares, no par value. Deal in and manufacture carbureters, vaporizers, accessories.

Austin Auto Supply Co., Inc., 5126 W. Madison St., Chicago., is another new company. Capital, $2500. Deal in automobile accessories. Incorporators: Samuel C. Harwitz, Meyer M. Willner and Leon Silvertrust.

D. M. Parkhill Motor Co., 211 N. Main St., Benton, Ill. Capital, $50,000. Operate garage and service station. Incorporators: D. M. Parkhill, J. R. Gardner and H. W. Blough.

Good Tire Business Ahead for Next Month

Springfield, O., June 16—Good business during the month of May is reported by the heads of the Kelly-Springfield Motor Truck Company, The Victor Rubber Company and the Springfield works of the International Harvester Company. Prospects are considered bright for this month. The Westcott Motor Car Company has been doing an exceptionally heavy business during the last two months. There has been a steady improvement in the trade of the Kelly-Springfield Company.

President E. S. Berlin, of the Victor Rubber Company, reports that the plant turned out and sold 13,225 tires during the month of May. Business prospects, he said, are good. The plant started with two shifts of men Monday.

The Springfield works of the International Harvester Co. is again up to its fifty truck schedule a day, and shipments are going forward rapidly.

NEW BETHLEHEM OFFICERS

New York, June 17—Howard B. Hall, former vice-president of the Bethlehem Motors Corp., has been elected president of the reorganized company, which is now understood to be amply financed so that it can immediately re-enter the truck manufacturing field.

M. Herbert Beary has been appointed special representative of the new company and has started on an extended trip through the west, on which he will appoint distributors and dealers.

Other officers of the new company are: W. H. Rodgers, secretary and assistant treasurer; D. C. Smith, factory manager of the Allentown plant; Louis K. Gordon, former associate engineer of Mack Trucks, Inc., and designer of the original Bethlehem trucks, chief engineer and purchasing agent, and W. H. R. Sandalls, factory manager at Pottstown.

NEW WHITE SERVICE STATION

Chicago, June 19.—The White Co. is erecting a new building at Archer avenue, Wallace street and Twenty-fourth place to house its Chicago branch and maintenance station. The building will have 55,000 square feet of floor space, nearly all on the ground floor. The location was selected after careful surveys which showed that it was the point which could be most conveniently and quickly reached by all the White trucks in service in Chicago.

GARAGE OWNERS' BULLETIN

Chicago, June 17—The Chicago Garage Owners' Association will begin the publication July 15 of a monthly bulletin to be known as The Garage News and to be sent to all members of the asociation.

Arthur O. Nelson, secretary of the association, states that many Chicago garage owners are materially increasing their summer business by serving automobile tourists whose arrival in numbers in Chicago is said to be earlier this season than in other years.

Tractor Sales Increasing in Columbus Territory

With Return of Confidence, Farmers Are Paying for Purchases with Notes

COLUMBUS, Ohio, June 19.—Distributors and dealers in this territory report an unexpectedly large volume of tractor and power equipment sales during the first five months of the year. Total business done by some tractor distributors and branches is more than four times that done in the same period of last year.

A part of this demand for tractors can be traced to the unusually wet weather experienced during the past spring. Frequent rains interfered with soil preparation and planting. A farmer would disk-harrow a field but before he could plant it, rain would come, and the harrowing operation would have to be repeated.

The tractor-drawn plows and harrows offered the only solution. Their superior speed enabled the farmers to prepare the bed and plant the seed between rains. And many farmers in this territory have bought tractors this spring because of this time advantage.

But this reason does not account for all the buying. Had similar weather conditions prevailed a year ago, little buying would have resulted. At that time the farmer's resources were too limited to permit of his buying.

The comparatively large volume of sales this year indicates that the farmers in this territory are rapidly recovering from the recent depression. They are making giant strides in their climb back to prosperity. They are adjusting themselves to the new conditions and they are buying tractors to help them in that adjustment.

The farmers are paying for their tractors for the most part with notes. In some cases no cash is involved in the transaction. Some of these notes extend to the fall of 1923.

Such paper is not readily salable to the bankers in this territory. The dealers must either be in a position to finance these sales or must have the assistance of the factory. A dealer representitng a line which is not factory-financed is consequently under a prohibitive handicap unless he can finance the sales himself.

This condition has obviously reduced sales but it has also limited such farmers as might be inclined to buy rashly. It has made the dealers investigate the financial status of their prospects with unusual care. Only farmers with gilt-edge credit have been allowed to purchase tractors with notes.

The banks have not adopted any rule against tractor paper. Some paper maturing next fall has been discounted. But, in general, paper maturing next year is not acceptable.

The farmers are, on the whole, satisfied with present tractor prices. They feel that the factories have done their share in getting back to pre-war levels.

CONCERNING MEN YOU KNOW

Benton Thompson, veteran in the Goodrich service, has been appointed Milwauukee manager of the B. F. Goodrich Rubber Co. Thompson, former manager of the Springfield, Ill., branch, succeeds **Jack Eager,** who has been recalled to Akron, Ohio, to take charge of the manufacturers' truck tire sales department.

Alfred Reeke, head of the Reeke-Nash Co., a member of the Tripoli, will attend the Golden Jubilee convention of the Shriners at San Francisco, Calif., in a Nash Four elaborately embellished with the insignia of the Shrine for an entry in the Shriners' parade.

J. O. Frisch, Fond du Lac, Wis., representative of the Advance Rumley Thresher Co., was awarded second place in the nation-wide sales contest conducted by the company this spring. Frisch is serving his 35th year in the Rumley company's service.

J. J. Hagner of the Hagner Auto Supply and Service Co., West Allis, Wis., celebrated his twelfth anniversary in business by the construction of an addition to his West Allis plant, making his plant one of the largest and most modern in the city.

H. V. Jones, president of the Sheridan Auto Supply, Inc., 3921-277 Sheridan Road, Chicago, announces the appointment of **E. C. Price,** Chicago, as director of sales.

Charles G. Barley, president of the Indiana Truck Corp., Marion, Ind., died June 11 at Indianapolis and was buried June 13 at Marion. He had been ill for two years.

W. B. Connelly of Cleveland has just been appointed branch manager of the Des Moines branch of the Mason Tire Co.

H. M. Baker, for two years branch manager of the Minneapolis office of the B. R. Goodrich Rubber Co., has been appointed district manager to succeed A. G. Underwood, who leaves after two years to go into the automobile department at Akron, O. **R. R. Huston,** northwestern district manager, becomes the branch manager, and C. C. **Martin,** district credit manager at Atlanta, succeeds **Huston** in Minneapolis. **Baker** was formerly credit manager at San Francisco and before that of the Boston district. **Underwood** had managed the Seattle district before he was ordered to Minneapolis and for two years before that managed the San Francisco offices.

E. C. McDonnell has resigned as general manager and vice-president of the Kelly Springfield Motor Truck Co., Springfield, Ohio. Frank H. Pietsch succeeds him. Pearl A. Lewis has been named assistant general manager. He has been associated with the company for years. Pietsch, formerly of Chicago, joined the Kelly force here several months ago as general sales manager.

Frank G. Carrie, until a few months ago vice-president of the Marmon Automobile Co. of New York, passed away at his home on Gerber's Island on June 10. He was 57 years old.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, used radiotelephony as the means of carrying a story of the progress of the automobile industry to thousands in the radio audience when he spoke from the broadcasting station WJZ at Newark, N. J., recently. He briefly reviewed the history of the automobile industry, spoke of the early trials of manufacturers and owners and contrasted these with the comparative perfection of the car of today. He also called attention to the growth of radio among automobile owners both for commercial purposes and for amusement.

Charles C. Peck, Jr., has been appointed general sales manager of the Traffic Motor Truck Corp., of St. Louis. He has been with the Traffic organization for over three years, first acting as manager of the New Business Department, then as assistant general sales manager.

Jack Cooper, in addition to representing the Walker Manufacturing Co., has become sales director of the E. A. Laboratories, Brooklyn, to succeed William Von Elm, who has resigned after three years' service as vice-president and sales manager.

Frank E. Stuyvesant, for years prominent in the automobile industry in this city, has retired from the active management of the Stuyvesant Motor Co., Hudson and Essex distributors. He remains as chairman of the board of directors of the company. **Harry L. Lance,** formerly manager for the Avenue Motor Co., Chalmers and Maxwell distributors, succeeds Stuyvesant as general manager of the Stuyvesant Motor Co. **E. G. Guthery,** vice-president, and B. J. Guthery, secretary and treasurer, are other officers of the company. **Calvin C. Eib,** who formerly was branch manager for the Overland at Denver, is general manager of the Stuyvesant Co., which in 1921 completed a new $1,600,000 sales and service building. It is one of the finest structures of the kind in this city.

Five Models of Star Car Shown by New York Dealer

New York, June 16—The first showing of the Star car in New York was given this week at the salesrooms of the Poertner Motor Car Co. Five models were displayed at the following prices: Touring car, $348, or $443 with starter and demountable rims; roadster, $319, or $414 with starter and demountable rims; sedan, with starter and demountable rims, $645; coupe, with starter and demountable rims, $580. All prices are f.o.b. Detroit. The touring model is the only one which has previously been shown.

After the touring car was exhibited at Washington March 9 and at the Boston show, it was withdrawn until the Durant factories were prepared to meet the demands with quantity production. Notwithstanding this fact, Star Motors, Inc., has on hand orders for several thousand cars.

THEY TAKE THEIR LOSSES

Rockford, Ill., June 19—Automobile dealers here solved their own "used car problem" after a fashion when they turned in all of such cars at an auction and sold them for what they would bring. Some sold as low as $45 and the top figure was $295. A number of trucks were disposed of at the same time. The sale represented a considerable loss to most of the dealers, as few of the cars that were sold realized as much as had been allowed for them in trades. However, the old cars were in the way, were occupying valuable storage room, and it was decided to move them, regardless of the loss.

NEW FARNER CAR PLANNED

Streator, Ill., June 17—Plans for the manufacture of a new automobile to be known as the Farner are being completed here by the Farner Motor Car Co., of which O. M. Farner is general manager. Farner states that all details for incorporation of the company will be completed in a few days, after which sample cars will be built.

It is planned to sell the car at $1195. It is to have 115 in. wheel base and 31x4 in. tires A number of standard units are to be used.

EXPORT PROSPECTS BRIGHT

Washington, June 17—Prospects of American automobile exports, passenger cars and trucks, during the coming summer months, are reported to be exceedingly bright. This is based on the reports sent weekly to the Bureau of Foreign and Domestic Commerce of the Department of Commerce from attaches of that department stationed throughout the world.

Fordson Tractor Demand Far Ahead of Production

Sales Booming in All Parts of Country Except a Few Remote Districts of Northwest

DETROIT, June 19—Demand for Fordson tractors is reported by the company to be running far ahead of production, some of its branches having in excess of one thousand orders ahead. The tractor delivery situation has been very tight for the last 60 days, the company reports, the demand coming from all of the country except from several remote districts in the northwest.

Reports from its representatives in the field indicate an entire absence of stocked tractors even in eastern cities where last year considerable difficulty was experienced in finding markets. Shipments now have been confined only to those branches where the demand is pressing and for the present there will be no shipments of machines for display or demonstration purposes.

The heavy tractor demand is expected to continue until the latter part of July, when a temporary lull is expected preliminary to the opening of the harvesting season. A large fall business in tractors is looked for from the farming districts, and an important winter manufacturing schedule will be outlined in anticipation of heavy business in the spring.

Business in tractors for industrial uses is reported by the company to have shown remarkable increases since the inauguration of its campaign designed to show the usefulness of the tractor in an industrial way. This campaign will be pushed vigorously, as the company plans to develop an industrial tractor business which will be commensurate with its farm business, and thereby furnish an all-season outlet.

Though there has been no official word as to the company's plan for production of heavy duty trucks, there are indications that these will be abandoned in favor of the plan to promote the tractor, used with a trailer, for industrial hauling. To further this plan there is a likelihood that Ford will enter the trailer manufacturing field so that the vehicle may be sold as a unit.

ADDS TO ENGINE FACTORY

Pontiac, Mich., June 17—Owing to the continued increase in demand for Willys-Knight cars, a portion of the No. 3 plant of the Wilson Foundry & Machine Co., of this city, has been assigned for the expansion of the motor division, to permit for the second time the doubling of Willys-Knight engine production.

TEN PER CENT FIRST OWNERS

Syracuse, June 17—The Franklin Automobile Co. reports that a notable feature of its business is the number of cars being delivered to persons who are buying a car for the first time. The percentage runs as high as 10 per cent.

The Readers' Clearing House

Questions & Answers on Dealers' Problems

Alley of Little Value If Often Blocked by Wagons

PLAN 413

Q—Please assist us in planning a building for a town of about 1,200 people. We have a site on Main street with a 50-ft. front facing the south, extending back 150 ft. with a privilege of 33 ft. in the rear by 100 ft. to the east, facing a side street off of Main which could be used as a rear drive, if necessary to have building that long. This is one point in particular on which we desire to have you help us, as there is an alley running through the block on the west and we are undecided as to which would make the better exit.

We want a front drive off of Main street about 12 ft. wide, a showroom and accessory store and office on one side of driveway, a women's restroom and washroom on the other. We also want a good size stockroom, work shop, tire department, battery department, washrack, burning-in- machine, drill press, lathe, emery stand, motor stand, axle stand, cleaning stand, and table for small parts cleaning, and room for storage for a number of cars.—C. L. Hollenbaek, Keithsburg, Ill.

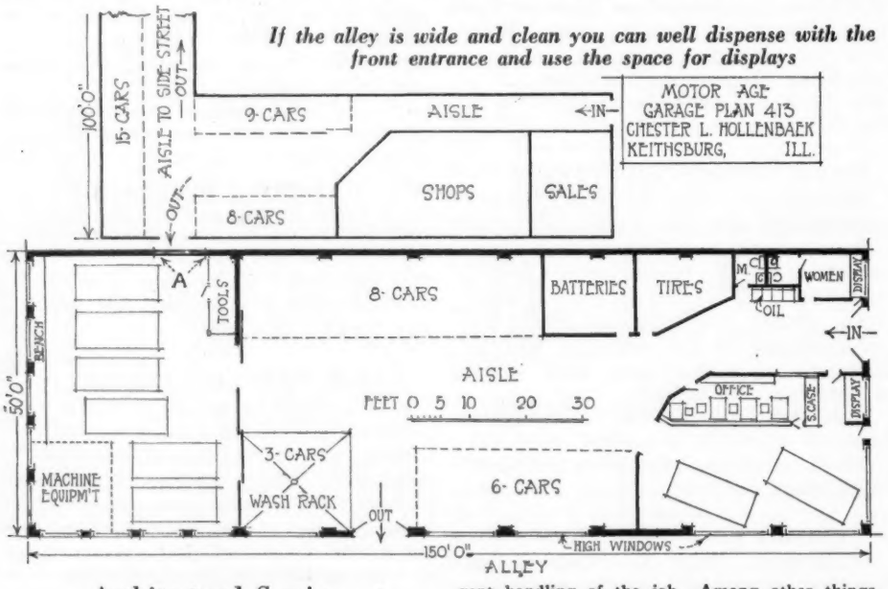
In planning this garage, everything depends on the condition of the alley, its width, the traffic in it, and its cleanliness. If you could use the alley and the side entrance, you would gain a great deal of valuable frontage space for showroom and office purposes, but if it is filled with coal and garbage and express wagons and trucks most of the time, its use is out of the question.

If the layout without the 33-ft. extension provides storage space enough, we consider it the best layout, but if more cars must be stored, a gain of 15 could be made by the addition as shown in the small diagram.

Extending the building back 33 ft. would increase storage in the large layout by 10 cars, but an outlet to the side street could only be had through the shop at A.

There is no stockroom included in the layout, but it could be included at the expense of one of the other departments. Very good stockrooms are built upon balconies over storage space, and if planned when the trusses are built, they may be made strong enough to carry the extra load, thus avoiding posts.

If the alley is wide and clean you can well dispense with the front entrance and use the space for displays



Architectural Service

IN giving architectural advice, MOTOR AGE aims to assist its readers in their problems of planning, building and equipping, maintenance stations, garages, dealers' establishments, shops, filling stations, and in fact, any building necessary to automotive activity.

When making request for assistance, please see that we have all the data necessary to an intelligent handling of the job. Among other things, we need such information as follows:

Rough pencil sketch showing size and shape of plot and its relation to streets and alleys.

What departments are to be operated and how large it is expected that will be.

Number of cars on the sales floor.

Number of cars it is expected to garage.

Number of men employed in repair shop.

And how much of an accessory department is anticipated.

The Readers' Clearing House

THIS department is conducted to assist dealers and maintenance station executives in the solution of their problems.

In addressing this department, readers are requested to give the firm name and address. Also state whether a permanent file of MOTOR AGE is kept, for many times inquiries of an identical nature have been made and these are answered by reference to previous issues.

Inquiries not of general interest will be answered by personal letter only. Emergency questions will be replied to by letter or telegram.

Addresses of business firms will not be published in this department but will be supplied by letter.

Technical questions answered by B. M. Ikert, P. L. Dumas and A. H. Packer; Legal, by Wellington Gustin; Paint, by G. King Franklin; Architectural, by Tom Wilder; Tires, by a Practical Tire Man; General Business questions, by MOTOR AGE organization in conference.

WIRE SIZE CHANGES

Q—What changes in size of wire required would be necessary to make a magnetizer as shown in the April 20 issue of MOTOR AGE so that it would be suitable for use on 32 volts instead of on 6 volts? —R. H. Reed, Heaton, N. D.

The general procedure in redesigning a coil of this kind is based on the fact that when the voltage is doubled that the size of wire is cut in half, in which case twice as many turns will go in the same space. For this reason, we would have the following table of voltages and wire sizes:

6-volt magnetizer, No. 12 wire
12-volt magnetizer, No. 15 wire
24-volt magnetizer, No. 18 wire
48-volt magnetizer, No. 21 wire

It will be noticed that in this table each voltage is double the previous voltage. It will also be noticed that each wire size is three greater than the previous wire size, as the wiring table rule is that for every change of three sizes the wire area is cut in two. For a 32-volt magnetizer, we would have to approximate somewhere in between the No. 18 and the No. 21 wire, and while No. 19 would seem to be the closest, we believe that No. 20 would be practically the best, and would not overheat quite as much as the other size. The weight of wire will be the same no matter what size you get, and the number of turns does not need to concern you, as all you will do is use the smaller wire and fill up the space.

HYDRAULIC TURBINE DRIVE TRANSMISSIONS

Q—Supply me with any and all information you can regarding hydraulic or turbine drive transmissions for motor vehicles.

2—Also would appreciate any information you can give me regarding dual or multiple valve grinders, either hand or electric driven.—R. F. Hoffman, Toledo, Iowa.

1—We would advise that if you wish to secure data on the hydraulic transmission that you secure the November 14, 1912 issue of MOTOR AGE. A very comprehensive paper regarding hydraulic transmission was reprinted from the journal of the American Society of Mechanical Engineers. Probably a copy of this journal can be secured by addressing the Engineering Societies Bldg., 29 West 39th St., New York.

2—This will be answered by letter.

Changes in Ford Design

Q—Is there any difference in the weight of the Ford roadster, touring or sedan wheels? Is there any difference between front and rear wheels and are the spokes heavier in rear wheels on the models from 1912 to 1922?

1—There are two makes of Ford wheels used as regular equipment on the Ford cars. One is the Hayes and the other the Kelsey. There may be some slight difference in weight and construction in the two different makes of wheels but the front and rear wheels of any set are of the same weight. The spokes are of the same weight both front and rear.

Changes in Ford Frame

2—Are the sedan frames heavier than the roadster from 1912 to 1922? Have there been any changes made in the frames since 1912?

2—The frames of both enclosed and open models are the same in the Ford. There were certain changes made in the 1914 model of frame which affected all of the body models, this was the side member right, side member left and the rear cross member. With the exception of these changes the frame of 1909 is a duplicate of the frame of 1922.

Changes in Crankcase

3—What difference is there in the lower crankcase from 1912 to 1922?

3—The crankcase was changed in 1917 at the front end where it was suspended from the front frame cross member. The crankcases from 1917 to date are interchangeable, also all crankcases built from 1912 to date will interchange. The changes on the crankcase proper did not affect its installation, that is, at the three points on the frame.

Ford Belt Lengths

4—Why are there 3 lengths of fan belts and where does the difference come in?

4—Three different lengths of fan belts are necessary because of the change in the design of the fan and fan pulley and the fan driving pulley on the crankshaft. The 1909 to 1916 engines used a fan belt 23 in. long. The 1917 to 1920 fan belt 26 in. long. 1922 cars were equipped with the new style fan which has a larger pulley and requires a 27 in. belt.

Bearing Stresses in Racing

5—Which will stand the highest speed as in a racing car and all side thrusts and strains the Timken or Shafer Roller Bearings?

5—We are unable to answer this question definitely. The Ford company spent considerable time in developing a suitable front wheel bearing and we wish to state that the Timken bearing used in the Ford front wheels is of special design. It is not similar to the regular Timken bearings because of the absence of the nibs or shoulders at the end of the rollers which in the conventional Timken bearing are used to take the end thrust. We have heard of cases where the Shafer bearing was installed with satisfaction to the owner. Nevertheless we feel inclined to think that the Ford regular equipment of bearings for this point would be at least as good as any substitute bearing.

6—What is the Ford compression ratio and how is it figured?

6—The compression ratio of an engine is the ratio of the volume of space above the piston at top dead center to the ratio of the volume of the piston sweft space at lower dead center. The smaller the comparative space between the piston and top of combustion chamber the higher will be the ratio. It is impossible to secure the exact compression ratio of the Ford engine from the data that is available at the present time. A 4 1/3 to 1 compression ratio would mean that the volume of gas space above the piston at top dead center was related to the amount of volume with the piston on lower dead center as 4 1/3 is to 1, in other words, 4 1/3 times the area displaced by the piston on its stroke than there was above the piston at top dead center.

Ford Compression Ratios

7—What is the compression ratio of the old models? What is used in Ford racing and how is the proper compression ratio figured, if we want to make a racer out of our Ford?

7—We do not know the compression ratio of the old model Ford, but have been informed that it is slightly higher than the compression ratio used in the present day model.

The gage compression on the new model Fords is approximately 55 lbs. In constructing a racing car from a Ford engine the compression ratio is raised by the installation of a valve-in-the-head. The manufacturers of this equipment for Fords have built heads of varying compression ratios and we would state that for speedster work a gage compression of about 80 lbs. should be used, while for exclusive racing it can be raised to as high as 90 in the Ford engine. We cannot state if there is any proper ratios, the exact ratio can be found only by experiment as too high a ratio will cause pounding and in many cases pre-ignition. If you do not intend to use overhead valves we would suggest that you start out by first planeing not more than ⅛ of an in. off of the cylinder head which gives you a compression pressure of approximately 65 to 70 lbs.

Hill Climbing Ratio

8—Which is best for hill climbing and traveling over a rough country 27x3½ or 29x3½ or 30x3½ wheels, standard Ford gear ratio 3.63 to 1?

8—The size of wheels to choose is dependent on the maximum revolutions of the engine and its power and torque characteristics. For a stock Ford engine in excessively hilly country we would advise 27x3½ wheels.

Highest Ford Engine Speed

9—What is the fastest possible speed we can get out of a Ford engine, the Ford fixed up the best man knows how? —Arnold C. Gunderson, Minneapolis.

9—We should state that if you secure 3,500 r. p. m. that you have about reached the limit possible without any great constructional changes of the Ford.

IGNITION AFFECTS ACCELERATION

Q—We have an Overland four cylinder car that runs well at idling speeds, but stepping on the accelerator makes it act as if it had run out of gasoline and begins to spit and sputter, although changing the carbureter adjustment does not correct the trouble. Can you tell us what might be the cause of this condition?

1—The best way to locate trouble of this kind is first to check up the ignition and this can be done by getting all of the wires loose on the spark plugs and then running the engine. One wire at a time can now be removed from its spark plug and held within 3/16 in. of the engine so as to form a spark gap; the sparks can then be counted at low speed to see that they hit regularly and do not miss.

If the sparks miss occasionally at the 3/16 in. gap or perhaps will not jump unless the gap is reduced to ⅛ in. it shows that the ignition is weak and a new coil should be tried. The spark can also be checked up at different speeds by operating the throttle of the carbureter at the same time that you are checking the sparks.

If the sparks are in good condition at various speeds there is nothing wrong in the ignition and it is then time enough to check up on the carbureter and engine. With good compression in the engine and good ignition, failure of the engine to accelerate would appear to be due to too lean a mixture.

If the ignition is giving trouble and the sparks are weak it may be do to the interrupter points being burnt so that new ones are required or the coil may be weak or the condenser may be poorly connected inside the coil.

2—At what distance should breaker points be set on this car?

2—Breaker points on the Connecticut ignition used on the Overland car are supposed to be set from .018 to .020 inches.

3—What is the valve clearance on this car?—C. B. Norris, Willow Shade, Ky.

3—Clearance between the valve stems and push rods can be from .003 to .005 inches.

TIMING OVERLAND

1—Give instructions for timing a Willys-Overland.—J. W. Redict, Fountain, N. C.

1—To check the timing of the sleeve remove the exhaust manifold to expose the exhaust port in the cylinders and introduce a small electric light through the spark plug hole of cylinder number one. Then turn the crankshaft slowly until, with the exhaust ports closing, a narrow pencil of light is barely discernable between the upper edge of the port and the outer sleeve and the lower edge of the exhaust port in cylinder block with the ports closing.

At this position the exhaust port closes and the mark 1 and 4 exhaust close or 1 and 4 E. C., should so indicate by registering with the guide mark on the cylinder block. This means that the exhaust ports should have just closed when the mark E and 4 E. C. is in line with the guide mark on the cylinder block.

Quick Starting System on Lincoln

Q—Explain the action and construction of the Packard fuelizer, also the system used by Lincoln for quick starting.

1—Lincoln cars are provided with a heating element which is made of Chromel wire. This is located at the lowest point of the carbureter near the air inlet. When the strangler handle located on the instrument board is pulled out, an electric circuit is closed through the heating element, which carries about 100 amperes for 8 or 10 seconds. The current which passes through the heating element also passes through two sheet metal contact switches, which are shown in Fig. 1. One leaf of this double switch is composed of Invar and brass, which form a thermostat. This thermostat automatically opens the circuit through the heating element at the end of the period mentioned, thus conserving energy taken from the battery and also preventing the possibility of fire or burning out of the heating element.

The action of the heat upon the liquid gasoline results in the formation of a fog and some permanent gas in the inlet pipe, and this mixture is then quickly drawn into the engine by cranking with the starter. The mixture is very easily ignited and makes it possible to start almost immediately upon cranking the engine.

Construction of Packard Fuelizer

A cut-away view of the Packard Fuelizer is shown in Fig. 2. It consists of a small supplementary carbureter and a burning chamber where the gas from the little carbureter is burned. This chamber is situated in the intake manifold. When the gas enters, it is ignited by a regulation spark plug, and passes into the fresh charge going from the carbureter to the cylinders. The heat of the burnt gases changes the wet, poorly carbureted gas mixture to a dry vapor, which explodes with better efficiency when it is touched off by the spark in the cylinder. The action of the fuelizer is automatic, and involves no moving part. When the engine is starting, the fuelizer is in full operation, and the heat supplied to the charge becomes less as the throttle is opened. This regulation is provided by an air-valve similar in operation to the air-valve of the main carbureter.

Through a small Pyrex glass window the operation of the fuelizer may be seen. A perfect mixture produces a purple flame, a fairly rich mixture produces a bluish-green flame.

Gas Consumption Too High

2—I recently had a vacuum tank thoroughly tested by Stewart agency, and they pronounced it in good condition. Without vacuum tank using auxiliary gallon, I can get 16 miles to gallon, and with vacuum I get only 7 miles to gallon. Explain possible trouble beside vacuum tank flooding over.

2—One of the possible causes of this is that the line connecting the inlet manifold to the vacuum tank valve is leaking, causing gasoline vapor to be drawn up through the valve and into the inlet manifold. It is quite difficult, though, to understand how the gasoline consumed could be twice the amount used by the gravity tank without noting some evil effects usually attendant to an over-rich mixture. It would seem that the exhaust would give a pronounced odor of this rich mixture and that the engine would knock on acceleration and show a tendency towards erratic operation. This leads us to believe that it might be a good thing to thoroughly go over the main pipe line in search of a leak. If none of these suggestions enable you to eliminate the trouble, we would advise that you return the tank to the Stewart company, who will supply you with a new tank if necessary.

Line Reaming Bearings

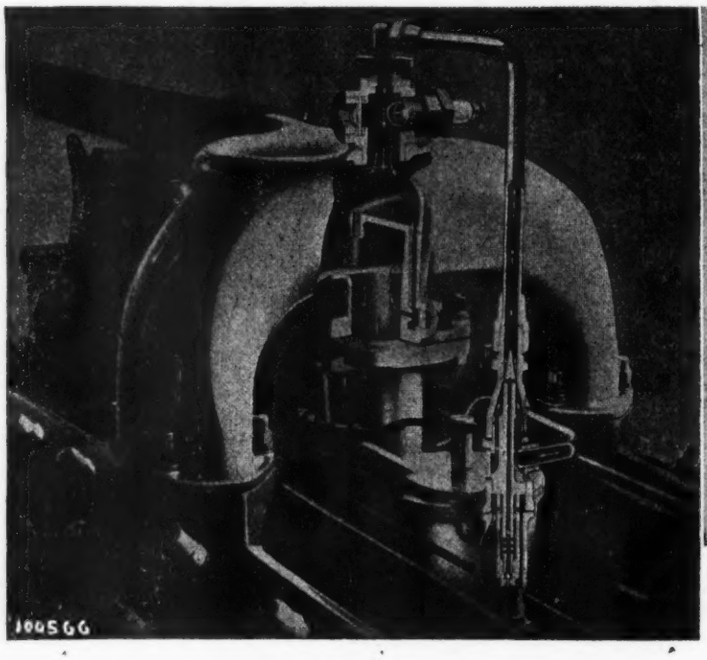
3—What assurance has a mechanic that the main bearings when line reamed without some sort of a guide are in line with the axes of the cylinders? Are not all line reamers made to be used without a guide for this purpose?

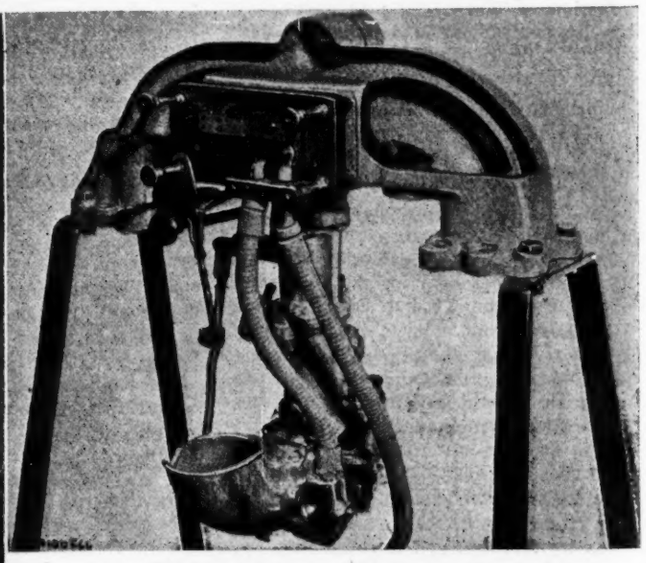
3—Some main bearing line reamers are equipped with a guide for positively aligning the tool. Generally speaking, most of the line reamers are equipped with some sort of a jig or pilot that enters the case so that the reamer is in the center of the crankshaft axis. Removable bronze back bushings as used today are generally made to very close limits, and when bearings are hand poured it is generally done around a mandrel which has previously been aligned with the cylinder casting, which will insure the alignment of the bearings for reaming. Any slight misalignment of the bearings in relation to the axis of the cylinders would not produce any detrimental effects any more than would offsetting the cylinders. The thing to be desired is to be sure the bearings are in alignment with the housing or recesses cut in the cylinder block for them, and also to get the proper crankshaft and camshaft gear clearance if gears are used. As before stated, in most cases where the bearings are poured they are poured around a mandrel which is previously aligned with the center line of the crankshaft journal bases. In the case of removable bushings, the two or more pilots with which each reamer is equipped will secure the necessary alignment.

Spark Plug Gaps for Magneto

4—Why should the spark plug gaps be less in a magneto system than in battery system?

4—The spark plug gaps in most magneto systems are set at a smaller distance because in the majority of magnetos there is produced less voltage and a higher amperage, which enables them to have approximately the same heat value as the battery system, but they will not have the ability to jump as great a gap. The battery system, because it generally has more voltage, accounts for the fact that the spark plug gaps as a general rule are wider apart on such a system. The smaller air gap of the plug electrodes in the magneto ignition sys-





Above—Fig. 1—Quick starting system on Lincoln

Left—Fig. 2—Cutaway view of the Packard fuelizer

tem does not necessarily mean that the magneto has lesser heat value to its spark than the battery system. This is not an absolute rule, and best setting for plugs and for interrupter points is the setting recommended by the manufacturer of the instrument.

Methods of Reducing Side Wall Pressure

5—What are all the different methods that have been used to serve the same purpose as offset wrist-pin and offset cylinder blocks; that is, namely, the reduction of side pressure of the piston against the cylinder wall? Name all the cars using engines designed with some method of reducing the side wall pressure.

6—We believe that the devices as mentioned above are very inefficient in that they could only do any appreciable good when the connecting rod is at its greatest angle. At this point the side-wall pressure would be very much if the pressure on the top of piston was high; but the pressure on top of piston is less than at the start of power stroke. Discuss this matter fully and state where I can be enlightened fully on this subject. — E. Shetzen, c/o L. R. Strauss Motor Co., Atlanta, Ga.

5—The methods most widely used today for reducing the side thrust of the piston against the cylinder wall are offset cylinders, offset crankshaft and offset piston pins. We know of no other method outside of using a long connecting rod and very long pistons, that is in use today to overcome or reduce this pressure. Without going into a lengthy discussion, we would state that for anything but low speed engines the offset cylinder engine has very little to commend it. Offset piston pins, on the other hand, show a reduction in the side thrust which undoubtedly is justified.

We are showing curves in Figs. 1 and 2 which represent the value of the side thrust forces on the cylinder wall plotted against the piston displacement and side thrust forces on the cylinder multiplied by piston velocity squared plotted against the piston displacement. As the frictional drag of the piston on the cylinder wall consists largely of tangential force, due to the shearing of the oil film between the two working surfaces, which is similar to fluid friction,it may be assumed that the force will vary directly as to piston speed second power.

The curves obtained by plotting the side thrust load times the piston speed squared against piston displacement will be proportional directly to the work done in overcoming side thrust resistance during the cycle at a given engine speed. In all curves of side thrust and frictional resistance the points at which the curves cross the zero line denote points at which the side thrust changes from one side of the cylinder to the other.

From the curves in Fig. 1 it will be seen that on the outstrokes the offset engine has less side thrust than the symmetrical engine, while on both the instrokes the reverse is the case, the maximum thrust reached in the offset engine being much greater than in the symmetrical or conventional engine, in which the cylinders or crankshaft are not offset. It will be seen from these curves in Fig. 1 that the wear on the cylinder walls is somewhat greater in the case of the offset engine. If the total area of the two curves in Fig. 2 are compared, they are proportional about 8.05 to 8.32, respectively.

The offset engine having the higher value, in higher speeds, therefore, the offset engine fails to show an advantage due to the diminished value of the side thrust on the expansion stroke, as this is more than counterbalanced by the high values reached on the return strokes. When the speed is reduced the offset engine shows a distinct advantage on the expansion stroke. At 500 revolutions the inertia forces have fallen to 1/16 of their value at 2000 r.p.m., and the value of the side thrust will fall correspondingly; the explosion and expansion pressure remain sensibly the same, so that the advantage of the reduced side thrust during expansion stroke will, with such low inertia forces, considerably outweigh the disadvantages during the instrokes.

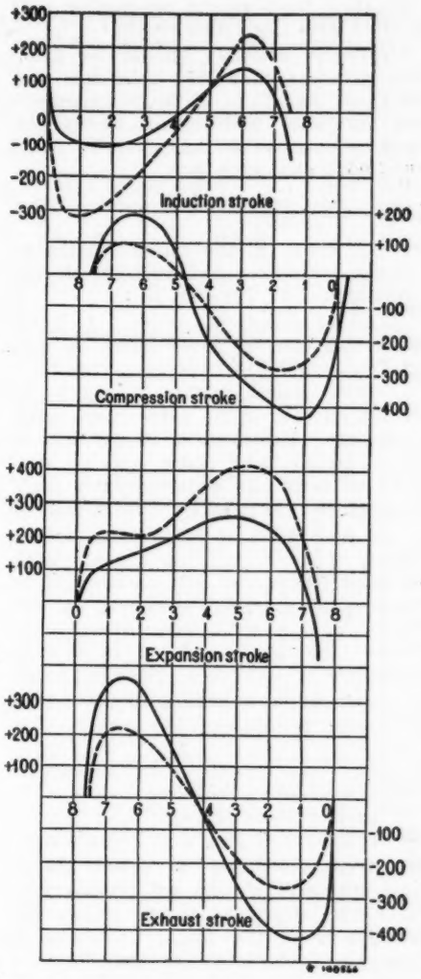


Fig. 1—Side thrust in pounds plotted against piston displacement. (Offset engine, full curve). (Symmetrical engine, dotted curve).

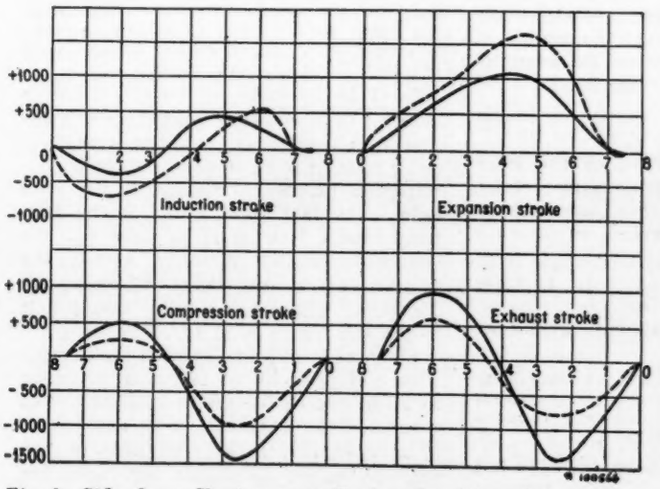


Fig. 2—Side thrust X piston speed² plotted against piston displacement. (Offset engine, full curve). (Symmetrical engine, dotted curve)

Offset Piston Pin

The effect of the offset piston is to bring both the center of gravity and the center of gas pressure outside the piston pin center, enabling both the inertia load and the gas load to exert a couple on the piston which will tend to cause its rotation in the cylinder about the piston pin center. An analysis of the different movements of the piston in the cylinder during the various strokes of the engine would require considerable space, so will not be dealt with here. The piston slap is most noticeable at low engine speeds, so the offset piston pin construction, we are led to believe, would be of value in reducing the tendency toward piston slap at this speed. As the engine speed increases, there will probably result a very distinct knock, which takes place on the peak of the explosion and which will occur once during each cycle.

For a full treatise on the effects of offset cylinders and offset piston pins, we would advise that you communicate with the International News Company, New York, and secure from them the March, 1922, issue of The Automobile Engineer, which contains an extensive article written by J. B. Swan; if you are unable to get this number of The Automobile Engineer, we would advise that you then communicate with Automotive Industries, The Class Journal Publishing Company, New York, N. Y.

Regarding just what causes piston slap, we would state that piston slap occurs at or near the point where the side thrust changes sign; that is, where the thrust is changed from one side of the cylinder wall to the other, which causes the piston to move from one side of the cylinder to the other with more or less violence. This is brought about two ways by the piston trying to turn about the piston pin axis and thus lying obliquely in the cylinder, and then, as

the side thrust increases after a change of sign, the piston transfers itself completely across the cylinder. Or by the piston transferring itself bodily across the cylinder without any rotation. Piston slap apparently varies as side thrust and inversely as engine speed. In normal running at normal temperature, piston noise is at its worst when the engine is developing a high torque at low speeds.

Overhauling a Series 4 Mercer

Q—I am going to overhaul a Series 4 Mercer and want to do a first class job, and wish you would answer the following questions concerning this car:

1—At what speed does the Mercer Series 4 develop its maximum power?

1—The Mercer series 4 develops a maximum of 74 h.p. at 2800 r.p.m.

2—What speed should the 4-passenger sport model make?

2—These cars vary considerably, but the average one will show 75. m.p.h. or better.

3—What is the gear ratio of this car?

3—The gear ratio is 3.62 to 1.

4—Can an alloy piston be fitted so as to keep engine from using excessive oil? If so, how?

4—Alloy pistons can be fitted to this engine, and it is recommended that this be done, because the series 5 Mercer carries aluminum alloy pistons as regular equipment. In order to use the new type Mercer aluminum piston, it is advised that you secure the new style short connecting rod. However, we are informed by the local Mercer service station that any of the constant clearance aluminum pistons supplied by replacement manufacturers can be used with the long rods, such as are used in the series 4 engine. If the cylinders are within .002 or .003 of being circular at all points, there will be no oil pumping if the aluminum pistons are used.

5—Are alloy pistons better than cast iron for this car?

5—Based on the fact that the later type Mercer uses the aluminum pistons, we are inclined to think that perhaps these are the best pistons.

6—Fitting in a new piston, would it be O. K. to lengthen pistons ⅛ in. to raise compression? Is it advisable?

6—We would advise against raising the compression.

7—Do tappets have to be adjusted to .006 to keep from warping valves, or could this be reduced and noise likewise reduced by using a laminated valve?

7—The tappets should be adjusted not less than .006 to prevent valve trouble. The Mercer company advises against the use of anything but stock Mercer valve.

8—Where can laminated valves be bought?

8—This information will be supplied by letter.

9—How many pounds compression can this car show?

9—It is not known exactly, but should be in the neighborhood of 85 lbs.

10—How tight should connecting rods be fitted with this oiling system?

10—These bearings should be fitted with not less than .001 clearance and not more than 2½. If the bearings are very carefully fitted and are nicely polished or burnished, they may be fitted with .0015 clearance dry.

11—Where can I get a chart of this engine oiling system?

11—A chart of the oiling system of this car can be secured from the Mercer Automobile Co., Trenton, N. J.

12—What method would you suggest of lubricating exhaust valve stems, as they get very dry and fit badly?

12—The easiest method would be to use the oil can on the valve stems quite frequently. However, it is possible to install an oil hand pump with an auxiliary oil tank and drill the valve plate or cover so that it would have a lead or jet to each exhaust valve stem or the vicinity of the exhaust valve stem. With the hand pump a stroke of oil could be given to the valves whenever it was desired. By using a very small pipe, directed against the exhaust valve stem or springs, we believe a sufficient stream of oil would be delivered to the valves to thoroughly lubricate the stem.

13—Is there any advantage in two spark plugs to each cylinder.—H. H. Shrewbridge, Leavensworth, Wash.

13—Better flame propagation is claimed for double spark plug and greater freedom from detonation or spark knock, especially with a high compression engine. The Mercer company advises the installation of the latest or Series 5 carbureter equipment for the Series 4 Mercer.

SEVERAL REVISIONS OF CHASSIS NECESSARY TO INSTALL AIRPLANE ENGINE

Q—Could a Hispano-Suiza airplane engine be used successfully in a Hudson or any other frame? The engine in question is either model E or model I, delivering 180 and 150 h. p. respectively.

1—It is possible to install either a model 1 or a model E Hispano-Suiza engine in a Hudson chassis, but it will require many revisions of the chassis construction besides a change in the rear axle. The maximum width of the Hispano model I or E is 37 7/16 in., the center to center distance across the crankcase mounting flanges which means the point where the engine would bolt to the sub-frame is 11 13/32 in.

This will require special sub-frame with a depression at the rear or offset to allow for the magneto bracket. It is true that the engine is a 90 deg. eight. It is impossible in these columns to give you any exact directions for installing this engine as it will require entirely too much space.

We have never heard of this engine being installed in a Hudson chassis but it has been installed in other cars with fairly good results. The installation depends entirely on the individual chassis and before any data can be given it is necessary to have the chassis at hand also the engine where accurate measurements can be made.

Using Hudson Flywheel

2—Could the original Hudson flywheel be welded on and the rest of the running gear be used?

2—The original Hudson flywheel can be fastened to the propeller hub flange but we would not advise welding on because such a procedure would be unnecessary and might result in distortion that would be detrimental to the engine. We doubt whether the Hudson clutch would have sufficient capacity to hold this engine and therefore would advise that you communicate with some of the makers of clutches of large capacity, for instance the Merchant & Evans Co., manufacturers of the Hele-Shaw clutch which is made in sizes up to 150 h. p. Before you select the flywheel we would advise that you get the dimensions on the clutch which you intend to use as these dimensions will prove of great help in determining the flywheel which will require the least machine work.

The frame will probably require additional cross members to provide the additional strength necessary on account of the power of this engine. To secure any speed with this car it will be necessary to have a gear reduction in the rear axle of not higher than 2½ to 1, this will mean either a special differential gear housing or an entirely different axle housing.

If you could secure a 1914 Cadillac rear axle of the two speed type which carries a 2½ to 1 ratio it would work very nicely with this engine. Heavier springs will be required if the Hotchkiss drive is used. Using a 2½ to 1 ratio and rear axle with a 3 speed transmission and 34 in. wheels will give a theoretical speed of only 60 m. p. h. If you cannot secure a 2 to 1 reduction we would advise that you install a 4 speed transmission overgeared in fourth to enable you to get sufficient propeller shaft speed if you wish to secure a reasonable speed from this power.

Magneto Would be Satisfactory

3—Could a battery ignition be used, for instance the one on the Hudson? Or would you recommend magneto system?

3—Battery ignition could be used but the change would be very expensive as the engine is equipped with high tension magnetos and would require special brackets for the installation of a battery system. We do not believe you will encounter any trouble with the present magneto ignition and ease of starting can be secured by installing a booster magneto with which each of these engines is equipped.

What It Would Cost

4—Could you, offhand, give me a rough estimate of the cost of such an operation, when the engine may be secured for approximately $300?—G. R. Hughes, El Paso, Tex.

4—A rough estimate of the cost of this operation would be as follows: cost of changes to frame such as addition of cross members, building of sub-frames, $150, cost of new clutch $100, four speed transmission $250. Special rear axle and springs approximately $600. These are only approximate prices and may be reduced considerably by purchasing second hand equipment.

Rules for Valve Timing

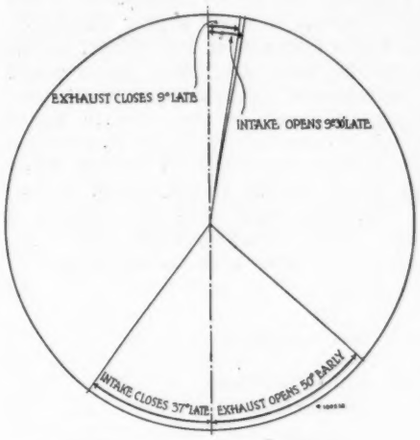
Q—Give me the rules for valve timing by degrees and explain it all.

1—The timing in degrees is nothing more than stating the time at which the valves open in relation to the graduation of a circle which is represented by the crankpin rotation or, as is often done, marked on the rim of the flywheel. An article on transposing timing in degrees to inches of piston travel was published in the Jan. 5, 1922, issue of MOTOR AGE. When it is stated that a valve opens 10 degs. after upper dead center, it means that that valve opens 1/36 of the total projected length of the flywheel or crankpin circle. The stamped marks on the engine flywheel of the automobile engine are nothing more than valve timing marks, which are laid off in degrees on the flywheel.

We say that 10 degs. means 1/36 of the total length of the circle because the circle is composed of 360 degs. As this timing of the valves by degrees is a fundamental of mechanics, we would advise that you secure some of the elementary books dealing with the theory and construction of automobiles. A book called Dykes' Automobile Encyclopedia should prove of great value to you in more clearly defining the meaning of timing valves by degrees. Some men connected with the service stations are of the opinion that motor cars and trucks cannot be timed unless the exact timing of that particular engine is known. While this is true to a certain extent, it does not hold good throughout.

The engine can be set at an average setting and will run, giving good service. Of course, if the exact setting of the valves is known, it is much better to set accordingly, rather than depend upon the rule of thumb. It is rather the exception for a service station to have an exact time setting for all engines, so we have calculated an average setting that will give satisfactory results for all engines, unless the engine is freakishly different from the rest, and the chances are better than 100 to 1 that the setting will be right rather than wrong. The pitch of the timing gears is generally coarse enough to allow only one proper setting, and when the proper position is almost reached the teeth of the camshaft gear which should mesh between the two teeth on the crankshaft gear will be so close that less than the width of one tooth will be between that and the exact position. This approximate position of the timing gears with reference to one another, as determined by the average setting for 114 cars, is as follows: Intake opens 9½ degs. late and closes 37 degs. late. The exhaust valve opens 60 degs. and closes 9 degs. late.

It is not necessary to pay attention to more than one of these dimensions when setting the camshaft, for the cams are generally all on the same shaft and integral with it, so that the relation between the different cams is constant. From this it follows that if one position is in accordance, the rest of the dimensions given will follow in their natural order. A diagram to be used for an average setting of the valves on an engine is shown below.



S. A. E. Horsepower Rating

2—Explain S.A.E. rating method and tell how to figure displacement in cylinder and the meaning of it.—James Mitchell, La Porte, Ind.

2—The S.A.E. rating is a formula devised by the Society of Automotive Engineers for securing a rule that would enable fairly uniform rating of different engines and which would enable the state laws which tax automobiles according to their h.p. to have a uniform method of taxation. The S.A.E. rating of an engine is approximately accurate if it is followed out fully and not as is generally done. The formula is as follows: The h.p. of an engine equals the bore of the cylinder or diameter multiplied by itself and multiplied by the number of cylinders then divided by 2½.

The addition to the formula is that this is applied to an engine having a piston speed of 1000 ft. per minute. Many engines have very nearly 2500 ft. piston speed per minute, which would mean that the formula would give them 2½ times the rating indicated without the modification. When applying for license the speed in ft. per minute of the piston is not included. Take the case of an engine 3 by 6 revolving at 3000 r.p.m., the formula when applied to this engine would work out as follows: 3 times 3 equals 9 times the number of cylinders, which in this case is 4, equals 36 divided by 2½ equals 14.4 h.p. But let us assume that the speed of the crankshaft is 3000 r.p.m.

At a crankshaft speed of 3000 r.p.m. the piston speed would be 3000 ft. per minute, because the stroke being 6 in. and the piston moves up and down once to a revolution so that the S.A.E. h.p. of this same engine at 3000 revolutions would be 3 times 14.4 or 43.2 h.p. This would come fairly close to being the actual h.p. delivered by such an engine with average construction rotating at 3000 r.p.m. By the term piston displacement of a motor is meant the volume of gas in the cylinders displaced by the pistons in their movement from the upper to the lower point of their stroke.

The piston displacement of any one cylinder is equal to the volume of a cylinder whose diameter is the bore and whose height is the length of the stroke. In other words, it is the cubical contents of a cylinder having the dimensions of the diameter and stroke on the engine. The piston displacement in cubic inches of an engine is found by multiplying the cylinder bore in inches by itself and then by .7854, then by the stroke in inches. This gives the piston displacement of each cylinder. If the product thus found be multiplied by the number of cylinders on the engine we will have the piston displacement of the engine. The formula for piston displacement is diameter squared times .7254 times stroke times number of cylinders.

REVERSING FORD GENERATOR

Q—Give method of reversing a Ford generator so that it will run anti-clock wise.—J. L. Horney, J. L. Horney-Roberts Battery Co., Clinton, Ind.

If you have old copies of MOTOR AGE you might refer to the November 10, 1921 issue page 19, Fig. 3, which shows the field circuit as connected to the third brush and the grounded brush. The reversal of direction in which the generator runs as a motor can be accomplished by reversing the field leads, but if the machine runs counter-clockwise and you make it generate in that direction, it will probably generate too much as the third brush regulation is being used the wrong way and will raise instead of lower the output.

The correct way to reverse the rotation of any third brush machine is to rebuild it with a left hand rocker ring as the third brush usually requires a different location. As a matter of experiment, however, you might try leaving the field lead on the third brush and taking the other field lead and changing it from the grounded main brush over to the insulated main brush. We rather suspect that the amount of movement that you have in the third brush will not be sufficient to give you enough charging current, but of course it is no great trouble to try this out and see what the result would be For greatest output the third brush should be moved in the direction of rotation as far as possible.

GRAVITY OF ELECTROLYTE

Q—What should the specific gravity of electrolyte be which is used in connection with batteries that are rebuilt with new positive plates and new separators.—Simmons-Woodyard Auto Co., Spencer, West Virginia.

1—Electrolyte of 1,400 specific gravity is usually recommended due to the fact that the separators have been kept moist and are full of distilled water which dilutes the acid to the proper gravity of 1280 or 1300. Of course, after the battery has been filled up and charged and discharged and recharged again until it gases freely the gravity should be checked and if it is too high should be reduced by drawing out a small quantity of the acid from each cell and replacing the amount withdrawn with distilled water. A common mistake, however, is usually made of using acid to low in gravity as it is rapidly thinned out by the water from the separators as above described.

An Interesting Problem in Power Requirements for a Machine Shop

Q—We would like information and recommendations in regard to layout of line shaft in our shop and also power requirements. We have a 20-in. by 10-in. Bradford engine lathe, a Cincinnati No. 1 Universal milling machine, a Gardner 4½ x 4½ air compressor capable of working up to 150 lbs. per sq. in., a grinder with two wheels, each 1½ in. by 10 in., and a 5 K.W. 110-volt D. C. generator. To drive the line shaft which will handle the above equipment, we are considering either the use of a 6 to 8 h.p. semi-Diesel oil engine or else a 7½ h.p. 220-volt, 3 phase A. C. motor. With the direct current generator driven from the line shaft, we would use but little lighting current supplied by the local electrical company, as this generator would not only be used for charging storage batteries, but also for supplying our lighting requirements. We are also located in the oil region of Pennsylvania, where the cost of fuel is comparatively low. — A Pennsylvania Reader.

1—Shown below is a diagrammatical layout of the power requirements referred to in the above inquiry. In laying out this sketch the dealers handling the equipment in question were consulted and the horsepower requirements noted on the sketch are in accordance with their recommendations. In considering the power requirements four possible conditions have been laid out as follows:

A	h.p.
Gen. charging, 25%	2.1
Lathe	2.0
Milling machine	3.0
Total	7.1

The above power requirement is a very nominal one and shows the machine shop operating with the generator at 25 per cent capacity and one man on the lathe and another on the milling machine and does not take into account the fact that a man might start to operate the grinder or that the air compressor might come into service while the other power requirements were still effective. The question of power required for the line shaft must now also be considered and while this varies considerably it may be considered to be from 15 per cent to 40 per cent, which in this case would increase the power required to either 8.1 horsepower or 9.9 horsepower. From the foregoing it would appear that either the 6 to 8 horsepower semi-Diesel engine or the 7½ horsepower A. C. motor would be overloaded, the advantage in this case being in favor of the electric motor which is capable of carrying an overload for a short time without trouble while the Diesel engine if overloaded beyond its capacity might suddenly come to a stop. Three other possible power requirements have been tabulated as follows:

B	h.p.
Gen. 50% load	4.2
Lathe	2
Milling machine	3
Grinder	3
Total	12.2

C	h.p.
Gen. 50% load	4.2
Lathe	2
Milling machine	3
Grinder	3
Air compressor	5.4
Total	17.6

D	h.p.
Gen. 100% load	8.4
Lathe	2
Milling machine	3
Grinder	3
Air compressor	5.4
Total	21.8

In the headings entitled B. C. D. the horsepower indicated did not include the line shaft losses and if these are considered it will raise the total under paragraph B from 12 h. p. to either 13.8 or 16.8 h. p. while in section C it will raise the figure of 17.6 h. p. up to 20.2 h. p. or up to 24.6 h. p., and in section D will raise the figure of 21.8 h. p. up to 25 h. p. or 30.5 h. p.

It would, therefore, appear that the power requirements will be all the way from 8.1 h. p. up to 30.5 h. p., depending on the exact manner in which the machinery is used and a decision on this can only be made by the shop superintendent, who can analyze his requirements better than any outsider. In doing this, however, he must bear in mind that provision should be made for future growth for the power requirements will be bound to increase with increase in business.

Assuming that either of the driving means suggested would be satisfactory from a power standpoint, it will be interesting to figure the cost of operation. For the Diesel engine we can figure .6 pounds of oil per brake horsepower hour and from figures recently obtained we find that a carload lot of crude oil for operation of the Diesel engine can be obtained at 6c per gallon, a gallon weighing approximately 5 pounds, which would make the cost per pound 1.2 cents.

Now if we figure a 10 hour day and a 7½ h. p. load we will have 75 h. p. hours, which multiplied by .6 pounds will give 45 pounds of oil per day and at a cost of 1.2 cents will mean a cost of 54c a day for fuel. Compared with the 54 cents cost for fuel for the 7½ h. p. Diesel engine, we will now consider the cost of electrical energy for the 7½ horsepower 220 volt, 3 phase alternating current motor. Changing 7½ h. p. to kilowatts we have 5.6 k. w. and assuming an efficiency of 80 per cent we find that the input will be approximately 7 k. w., and then figuring a 10 hour day as before we have 70 K. W. H. (Kilowatt Hours) which at 6 cents per K. W. H. will be $4.20 per day.

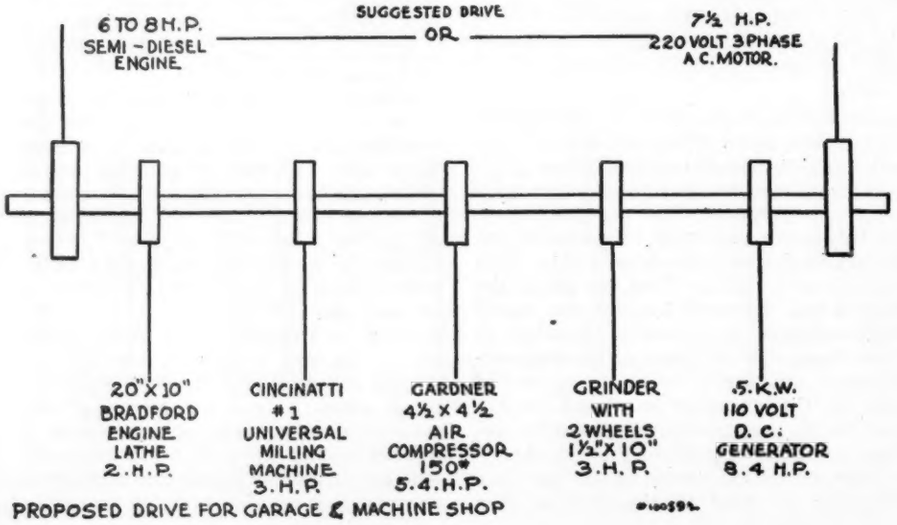
On this basis the decision would apparently be entirely in favor of the semi-Diesel engine, assuming that the oil can be purchased for the price indicated and that speed regulation with variation in load will be satisfactory. It should be remembered, however, that the cost of maintenance will on the oil engine exceed that of the electric motor in which there is nothing much to wear except the bearings. However, the difference in cost in operation will pile up a considerable reserve fund to be used for overhauling and maintenance.

Considering now the various power requirements which vary from using one or two machines and using all of the equipment at the same time we have the following table which shows a relative cost of the two means of drive.

H.P.	Cost of operating oil engine	Cost of operating electric motor
7½	$0.54	$ 4.20
10	.72	5.60
15	1.08	8.40
20	1.44	11.20
25	1.80	14.00
30	2.16	16.80

Comparing the last figures it will be seen that the difference between $2.16 and $16.80 is somewhat over $14.00 a day, which would be saved by the use of the engine. This seems to be quite a difference and in this connection investigation should be carefully made both to see whether with larger consumption the cost of electric current would be less and also to see whether the cost of fuel is as above indicated.

If for reasons not appearing in this article and diagram it should be decided to install the electric motor it will be


6 TO 8 H.P.
SEMI-DIESEL ENGINE
SUGGESTED DRIVE
OR
7½ H.P.
220 VOLT 3 PHASE A.C. MOTOR.
20"X10" BRADFORD ENGINE LATHE 2.H.P.
CINCINATTI #1 UNIVERSAL MILLING MACHINE 3.H.P.
GARDNER 4½X4½ AIR COMPRESSOR 150# 5.4.H.P.
GRINDER WITH 2 WHEELS 1½"X10" 3.H.P.
5.K.W. 110 VOLT D.C. GENERATOR 8.4 H.P.
PROPOSED DRIVE FOR GARAGE & MACHINE SHOP

interesting to note that the increase in size of an electric motor does not increase the cost proportionally. For example, when recent inquiry was made it was found that a standard make of motor was $575 for a 10 h. p. size and $660 for a 15 h. p. size which should make the 30 h. p. motor come well under $1,000. In the layout shown there is a considerable advantage operating the 110 volt D. C. generator if it is anticipated that the storage battery business will grow to any considerable extent as this generator is capable of charging 75 six volt batteries at a 9 amperes rate or 100-six volt batteries at approximately a 6.5 ampere rate so that an enormous business could be handled in this way. In analyzing this problem the point to be borne in mind will be the relative cost of fuel and electrical energy, the relative first cost of the engine and motor, the relative maintenance and depreciation of the two types of drive and the estimate of the approximate total power required at any one time, coupled with the fact that an electric motor is capable of temporarily carrying from 50 to 100 per cent overload while the engine is limited in this respect. The overload on an electric motor should, of course, not be for any sustained period as overheating will result.

TWENTY MINUTE DISCHARGE OF BATTERIES

Q—Explain about the 20-minute discharge on storage batteries.

1—The ordinary battery can be discharged in approximately 20 minutes or half an hour by using a carbon plate rheostat and a high reading ammeter, the initial discharge rate being from 100 to 150 amperes. The battery should be discharged until the voltage on each cell comes down to 1.8 volt per cell.

Using the Growler

2—How is the growler used for fault finding and how is a hack saw blade and phone receiver used in connection with the growler test?

2—In using the growler, voltages are generated in the different armature coils which with a good armature neutralize each other so that practically no current flows. With a defective armature, however, one which has a short circuit in one of the coils for example, we have a little local circuit in which current will flow. This produces a local magnetic effect which can be detected by holding the hack saw blade over the various slots as the magnetic action produced by the shorted coil will cause the hack saw blade to vibrate up and down making a characteristic noise. The various voltages produced in the armature coils will show up at the commutator and here a telephone receiver can be used connected across adjacent bars. As the armature is slowly turned in the growler the test points from the telephone receiver can be connected across different pairs of bars and if an unusually loud noise is heard it indicates an open circuit.

Enlarging Pistons by Heat?

3—How much can pistons be enlarged by heat?

3—It would be our opinion that a piston could not be permanently enlarged to any great extent by the use of heat although in normal operation of course the piston expands as it gets hot and then contracts again as it cools off. If a piston has been made to fit more tightly in the cylinder by being heated it is possibly due to being warped and made egg shaped rather than to its having been expanded permanently. The only real remedy for a loose fitting piston is to put in a new one the proper oversize.

Was This Battery Properly Rebuilt?

4—We repaired a battery, and after charging it we used Cadmium test, and the positive plates appeared to be alright, but the negative plates indicated only half charge. We dumped out the solution and added water and then charged the battery, then dumped it again and put in 1350 acid and charged for 72 hours, after which the gravity had come up to 1240. This process was repeated, 1350 acid being added, which again came up to 1280. The positive showed charge and the negative showed half charge. The Cadmium test was used with the battery warm and charging at the rate of 8 amperes.—A Reader.

4—Your description of the method used in charging the battery appears to be somewhat confused as you state that heavy acid was put in and that after charging it came up to a figure which is really lower than the acid at the start. We believe it possible that the trouble experienced is due to your putting in positive plates which were practically charged in conjunction with old negative plates which were practically discharged and if so this probably accounts for your trouble.

In rebuilding batteries the best procedure is to take the cells apart being very careful to leave the old positive plates in place. Any plates which are shorted can be temporarily insulated by sliding pieces of cardboard in between them at the corners or wherever they seem to be touching, then putting the cells back in the jars with the same old electrolite and putting them on charge until the negatives have been thoroughly charged, the old ruined positive plates being merely used for the purpose of bringing the negatives up to a good charged condition.

The negative plates should then be pressed and rebuilt with new positives and new separators and under these circumstances we do not believe you would find that the negatives were not properly charged.

PACKARD WIRING

Q—Publish wiring diagram of Packard 4-48 model, serial No. 51961.

1—Wiring diagram is shown below.

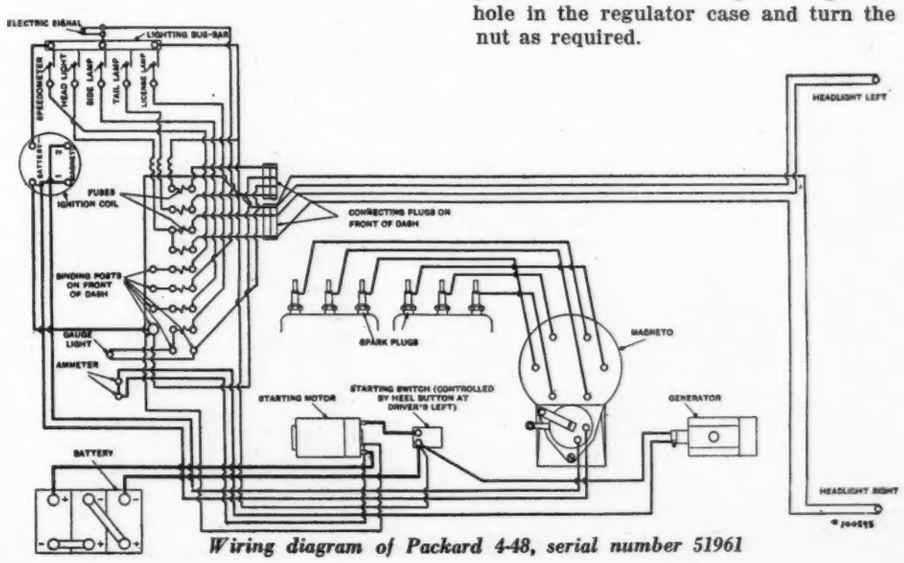
2—Would it be possible to change the wiring so as to use a single wire system with grounded battery?

2—It is not possible to use a grounded system on account of the fact that the Duplex magneto will not work with a ground in the system, the symptom being that the engine runs on three cylinders instead of six as soon as a ground occurs. If you wish to use dry cells however on the magneto coil so that the magneto electrical circuits would be separate from the other electrical circuits on the car it would be possible to use a grounded battery and grounded wiring for the starting and lighting system.

3—How can current be regulated on this type generator?—Alec Leonard, Crystal Falls, Mich.

3—Current output is regulated by means of the voltage regulator on top of the generator. By removing the cover you will see two pairs of contacts, those near the disconnect plug at one end of the regulator closing and acting as cut-out points to connect and disconnect the generator from the battery. The other pair of contacts vibrate at high engine speed to limit the charging current. Low charging current is due to the spring tension being too weak and this can be increased by turning the small nut which tightens the spring.

The intention of this regulator is that adjustments will be made by removing the plug which is in line with the adjusting nut and inserting a small socket wrench so that the nut may be turned to give the required spring tension. In most cases the proper socket wrench is not available and it is necessary to improvise one which will go through the hole in the regulator case and turn the nut as required.



Wiring diagram of Packard 4-48, serial number 51961

The ACCESSORY SHOW CASE

New Sources of Retail Profit

ELM CITY WINDOW ANTI-RATTLERS

These are attached by means of two screws near the part or window they are intended to silence and pressure is applied by the thumb screw tipped with rubber to prevent scratching. Price 20 cents each. C. S. Mersick & Co., 274 State St., New Haven, Conn. This company also makes combination license plate screws as illustrated. Price $4 per hundred.

LOMAR SHOCK ABSORBER

This shock absorber consists of a cylinder enclosed at both ends. Two arms terminating in a cam within the cylinder are attached to the car springs. The cam operates between two pistons which are separated from the ends of the cylinder by springs. The upper springs absorb the shock and the lower the rebound. An adjustment nut screwed into the top of the cylinder is used to adjust the spring to the load.—Lomar Mfg. Co., Middletown, O.

SAFE-T SEAT LOCK

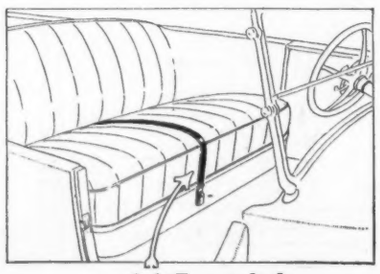
This lock is a band of tempered steel encased in artificial leather. It extends around the seat cushion and when the lock is attached prevents removal of the cushion and access to the tools by thieves. Price $2. Russell Mfg. Co., Middletown, Conn.

NEILSON ELECTRIC OIL GAGE

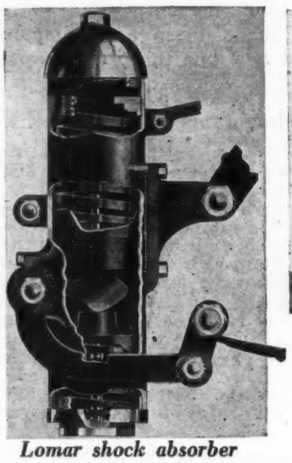
This device fits into the Ford transmission case at the top where oil is thrown onto it by the action of the rotating magneto. As long as there is sufficient oil in the transmission a small receptacle is kept full but when the supply is low the lack of oil in this receptacle causes it to raise and make a contact which is interpreted on the gage on dash. Price $6.50. George W. Doerr, 130 N. Wells st., Chicago.

DOVER HANDY OILER SET

The Dover No. 614 Handy Oiler Set consists of six one-half pint copper plated steel oilers with a heavy steel shelf, enamelled black. Each oiler has the name of its contents marked in steel raised letters: Gasoline, Kerosene, Machine Oil, Neatsfoot Oil, Kant Rust and Lard Oil. The shelf has two brackets at the back, which, with ordinary bolts, can be placed on the wall anywhere.—Dover Stamping & Mfg. Co., Cambridge 39, Mass.

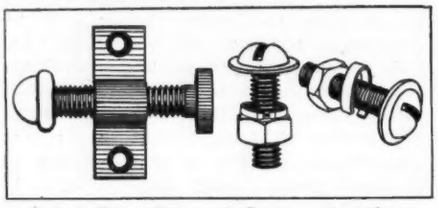


Safe-T seat lock

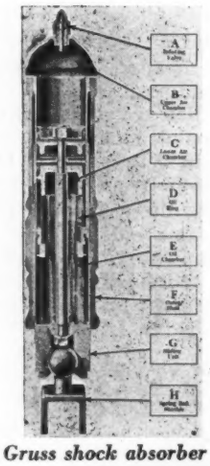


Lomar shock absorber

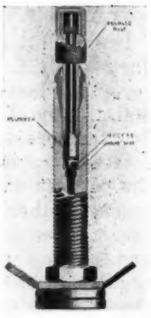
Registire tube valve



Left—Elm City window anti-rattlers. Right—License plate screws



Gruss shock absorber



All metal valve

Neilson electric oil gage for Fords

REGISTIRE TUBES

Registire tubes are equipped with valves, containing a pressure gage, as shown in the illustration. With this attachment, it is possible to tell at all times the number of pounds of air in the tube. Registire Co., Buick Bldg., New York City.

GRUSS SHOCK ABSORBER

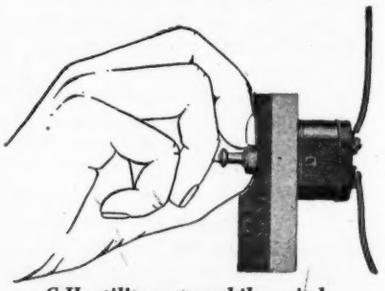
Gruss Shock Absorbers are made in four sizes, two passenger car sizes, a truck and bus size. Installation is effected by fastening "F," shown in illustration, to frame of car. Sliding unit "G" fastens to the end of standard spring on car. The original springs are not cut or altered in any way. Resiliency is obtained by the use of air, which is compressed into the two chambers designed to regulate to the load of the car and the roughness of the road.—Cleveland Pneumatic Tool Co., Cleveland.

ALL METAL VALVE

The All Metal Valve Co., 406 Kresge Bldg., Detroit, is the manufacturer of an all metal valve for pneumatic use. This valve is designed to retain high air pressure in pneumatic tubes and is so constructed that, when closed, it will retain any degree of air pressure that may be desired. The Holt Valve "inside" consists of only three all metal parts and does not contain any springs or rubber parts.

C-H UTILITY AUTOMOBILE SWITCH

For dash control of automobile lights, particularly courtesy and trouble lamps. To install, one hole is required ⅜ in. in diameter. Through this the long threaded stem is pushed, after which the locking nut is screwed in place. No plate is required. Adjustment of lock washers both sides of the surface on which the switch is installed, permits of securing the switch to different thicknesses of metal or wood. The operation is by means of a nickel plated push-and-pull button. Cutler-Hammer Co., Milwaukee.



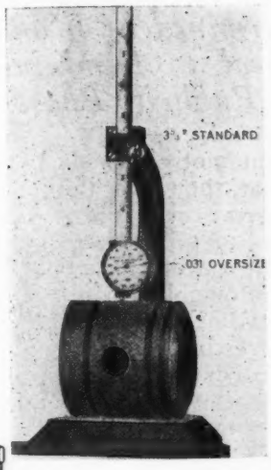
C-H utility automobile switch

SERVICE EQUIPMENT

Aids for Time Saving & Accuracy

MIKRO-INDICATOR PISTON GAGE

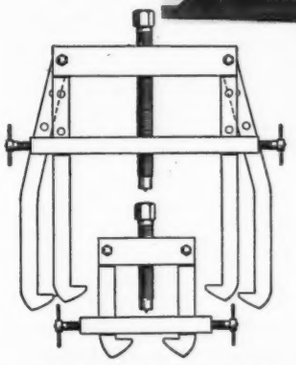
This is a dial indicator bench gage for checking the diameter of pistons, piston rings, and other cylindrical parts with diameters up to and including 6 in. Flat pieces can be checked for thickness. Variations are shown on the dial in thousandths of an inch; larger dimensions appear on the steel scale in inches, by sixteenths. Price $15.—George H. Wilkins Co., 180 N. Market St., Chicago.



Mikro-indicator piston gage

COOMBS GEAR PULLER

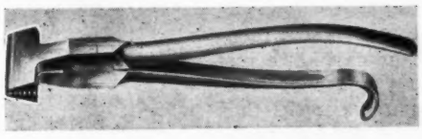
Made of high grade steel, heat treated with an aluminum finish. It has a ⅝ in. 11 thread screw, case hardened. All hooks are interchangeable in both large and small pullers. Price $5, complete, set. C. B. Coombs Co., State and Walker Sts., Indianapolis.



Coombs gear pullers

WESTERN 5-GALLON VISIBLE CURB OUTFIT

The Western outfit has a heavy, clear Flint glass cylinder into which the gasoline is pumped and from it, delivered to the tank. An automatic drain valve is attached to the pump which allows hose to drain out clean as soon as flow stops. Quantity stops, 1, 2, 3, 4, or 5 gallon stops are set in the cylinder. The height of the pump is nine ft. nine in. diameter 15 in. Western Pump and Tank Co., St. Louis, Mo.

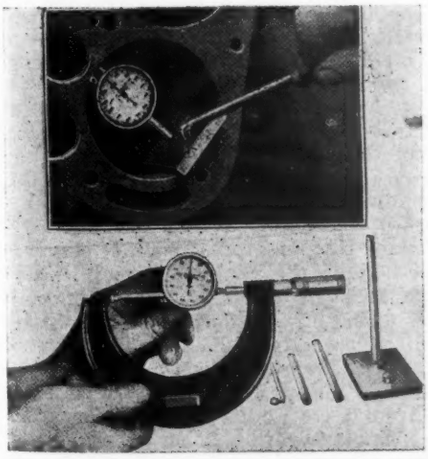


Krauter battery plier

HANDI-PAN

The Handi-Pan is a general utility article around the shop. It can be used to scrub parts in, store parts, carry tools, drain crankcases, catch scrap parts and test inner tubes in. It is 25 in. long, 15 in. wide at the top and 5½ in. deep; capacity 4 gal. A man can stand on the edge without tipping it. Price $2. Robertson Bros. Mfg. Co., 5401 So. Western ave., Chicago.

Western 5-gallon visible curb outfit



Mikro-indicator cylinder gage

Handi-pan

WRIGHT MULTIPLE VALVE GRINDER

The Wright Multiple Valve Grinder is operated by placing the tool on the cylinder head, over the first four valves, with the two pins of the locating bar in two cylinder bolt holes, and the clamping screw in a third hole. Turn down the clamping screw. It is not necessary to remove manifold, top hose, tin under dash or the valve springs.

Tipping the tool back on the pivot pins exposes the valves. A fine valve grinding compound should be smeared on the valves, somewhat more plentifully than when using hand tools, as but one application is made. A spring is placed (six are furnished with each tool) under each of the four valves, exactly as in hand grinding.—Wright Multiple Valve Grinder Co., Fitchburg, Mass.

KRAUETER BATTERY PLIER

This tool is designed for handling storage cells and plated. Jaws are 2 in. wide to distribute pressure over large area to prevent breaking of cells. Deep corrugations afford a good grip. Made of aluminum bronze forging and tempered to resist action of acid. Krauter & Co., Newark, N. J.

MIKRO-INDICATOR CYLINDER GAGE

This device consists of two units, the indicator or dial (which can be removed and used as an inside micrometer) and the saddle with a supporting stud upon which the indicator dial is placed and which holds it at right angles to the axis of the cylinder. The device will measure diameters from 2⅝ to 5 in. It can also be used for testing turned work in a lathe, for testing crankshaft bearings in a truing fixture and furnishes a direct reading inside micrometer by the removal of the indicator from the saddle. Price $15.—George H. Wilkins Co., 180 N. Market St., Chicago.

Wright multiple valve grinder

More Automotive Advertising Should be Directed to Influence Women Buyers

Factory Advertising Managers Are Told 75 Per Cent of All Sales Are Determined by Women — Copy and Literature With an Appeal to Feminine Tastes Outlined—Other Publicity Phases Discussed

THE advertising managers of 30 automotive vehicle factories were told Tuesday that they and the dealers had been overlooking a great opportunity in neglecting to make special efforts to sell cars to women. The advertising managers had met in Chicago in response to a call by the National Automobile Chamber of Commerce. The speaker in behalf of the women was Elizabeth Hallam Bohn, an advertising expert. Her statements were based on special questionnaires and a long study of the situation.

She said that 75 per cent of the car sales were determined by women. She said that most advertising writers did not have the woman in mind at all when they prepared the copy. The motor car had been built by men and was utilized by men, but that it had been socialized by women. She had never seen a single advertisement which appealed to the tired business woman and she could think of dozens of special pleas that could be made to this woman.

Things That Appeal to Women

More than 100 retail automobile establishments had informed her that they are making no sales of cars to single women, which the speaker thought was an excellent field. As to reaching the woman, she suggested chiefly recreational advertising and the publication of booklets on motor manners, what is necessary to know about a car, traffic regulations for the various communities and similar topics.

Miss Bohn's talk was more directly along the line of retail selling than any of the other comments of the day. The rest of the speakers were in and of the industry and they were taking the more or less conventional views of the topics they thought they understood very well. Edward S. Jordan, president of the Jordan Motor Car Co., was chairman of the meeting and John C. Long, educational secretary of the N. A. C. A., represented that body. Jordan described himself as the advertising manager of his company and said that he did not think he could have a bigger job. Sales, he said, were the life of the factory existence. The layout of an advertising campaign was the biggest day's work in any factory and it should be so considered by all concerned. If the advertising manager had not made himself an important factor with his firm, it was his own fault.

Service the Next Big Punch

Jordan, in addition to his task as chairman, was the speaker on "The Next Big Selling Punch." His view was that this would be service. He said that there must come a time in the near future when replacement sales would make the dominating market. Then would come a situation in which the survival of the factory would be based on the survival of the dealer, who in turn would survive only as the owner of the car survived as the owner of that particular make of car.

The car owner, Jordan said, bought transportation when he bought a car and his liking for that car was based only on the delivery of transportation, and the cost to him. In this, the readiness of the dealer to serve this man in keeping his car on the road was the biggest factor, and the price came next. Three factors made the price: The cost of the car, the cost of running it and the resale value. The first two must be kept at a minimum to please the owner and make him the repeat buyer.

Factory Advertising and the Dealer

A. B. Batterson, of Buick, was to have opened the meeting with a discussion of "Relationship of the Advertising Department to the Dealer." He wired that he could not be present and Jordan asked Clyde Jennings, Managing Editor of MOTOR AGE to take his place. Jennings said that he did not know of the relationship of the advertising. He said that the objective of advertising was to sell goods or assist in the sale and that at present in many instances it was not accomplishing that objective because the local dealer did not believe in the advertising that the company was putting out. The present job was to sell the dealer on this advertising and in that way hook up the advertising with the prospect. The fact that very few cars were sold in communities where there was no dealer, was the proof that even excellent motor car advertising would not complete the sale. The local hookup connection was necessary.

L. B. Dudley of Federal spoke on "Special Problems of Truck Advertising." His view was that this advertising had been too general and that concentration in the place of sale was necessary. He dwelt on the necessity of better dealers and more dealers who could make a living from their sales. He was rather critical of some recent advertising that used superlatives rather freely and which was unfair to competitors. He spoke for more advertising for truck transportation and for truck industry and less for the special truck. Dudley said that he believed that big task of the advertising department was in the selection of suitable dealers. He said that there were 22,000 truck dealers in this country and the total sales for last year indicated that there was an average of only six truck sales to the dealer and until there were heavier average sales, a proper personnel could not be recruited.

S. R. Swiss, in the discussion, said that in his opinion there would not be a proper dealer representation until there was a greater appreciation of the value of a sales franchise. The franchise must be made of such value that a dealer would build for 20 years hence, just as another merchant does.

Advertising the Used Car

"Advertising Used Cars" was discussed by G. U. Radoye of Haynes. His idea is that the classified columns are the best for finding the buyer, but that display advertising can well be utilized for character building for rebuilt cars. He showed samples of the advertising published last winter by the Triangle Motors Co. of Chicago, Haynes dealers, in an effort to popularize rebuilt cars.

In the discussion of these topics there was much evidence that several manufacturers are considering bill board advertising, some as a substitute for magazine advertising and some as a help. Some manufacturers are realizing the expense of advertising nationally when their dealer organization is not national. A marked tendency is to advertise where cars are sold. It was indicated that the present practice of sharing local advertising expense with the local dealer may be abandoned and the dealer and distributor required to pay the entire expense of local promotion. Several talks indicated that the day of free press notices had passed and that hereafter publicity must be for automotive use, rather than for the individual vehicle. One comment on billboard advertising was that in many cases instead of paying for a billboard in the community, the manufacturer had better spend the money on painting the dealer's establishment and making it the billboard for that community.

COMING MOTOR EVENTS

AUTOMOBILE SHOWS

Hartford, Conn.	Connecticut Fair Grounds	Sept. 4- 9
Spokane, Wash.	Annual Show	Sept. 4-9
Chicago	Annual Show of the Automotive Equipment Association	Nov. 13-18

RACES

Tacoma, Wash.	Eleventh Annual Race	July 4
Strasbourg	French Grand Prix	July 15
Colo. Spgs., Colo.	Pike's Peak Race	Sept. 4
San Carlos, Cal.	500-Mile Armistice Day Race	Nov. 11

FOREIGN SHOWS

Berlin	Kaiserdamm Hall	Sept. 25-Oct. 3
Rio de Janiero	Automotive Exhibition	Sept., 1922
London	International Commercial Vehicle Exhibition	Oct. 12-13
Paris, France	Automobile Show	Oct., 4- 15
London	Annual Show	Nov. 3-11

CONVENTIONS

Colo. Spgs., Colo.	Automotive Equipment Assn.	June 19-24
White Sul'r Spgs., W.Va.	S. A. E. Summer Meeting	June 20-24
Olympia	Washington Automotive Trade Assn.	July 21-22

PRICE OF THE HB CONSTANT POTENTIAL CHARGING OUTFIT

Through an error in transcribing the price of the HB constant potential charging outfit was printed as $165 in the June 8 issue of MOTOR AGE, page 15. This should have read $160 deposit with order and the balance in ten monthly payments of $50 each. Hobart Bros. Co., Troy, O.

PATERSON NOW USING NEW CONTINENTAL ENGINE

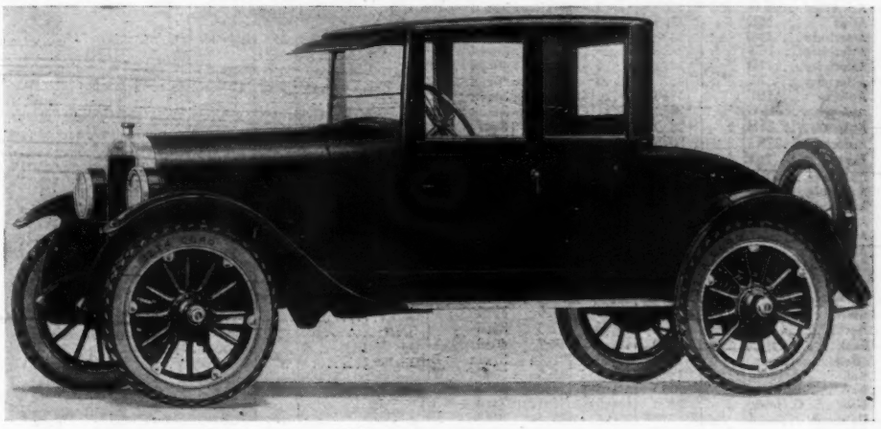
Announcement has come to hand that the Paterson model 6-52 is now equipped with the new Continental model 8R engine. This model has a bore and stroke of 3⅜ by 4½ in. respectively.

Why Lumber Is Steamed During Kiln Drying

There seems to be a common impression that the purpose of steaming lumber is to "remove the sap." This is far from being the fact, for when lumber is steamed it takes on moisture, as a rule, instead of giving off anything.

The reason for steaming lumber during drying depends on when it is done, but nearly always the treatment is given for one of the following purposes: (1) To heat lumber through quickly at the start; (2) to relieve stresses which otherwise would produce checking, case-hardening and honeycombing; (3) to equalize the moisture content and condition the lumber ready for use at the end of the run; (4) to kill fungi and insects in the wood.

When lumber should be steamed, how long the treatment should last and what temperature should be maintained are points which have been determined at the Forest Products Laboratory by experiments on many species of wood. A thorough understanding of the steaming operation is essential, because the whole kiln charge can easily be ruined by too severe a treatment. One of the chief needs of many commercial kilns is proper steaming facilities, without which a high degree of success in the artificial seasoning of wood is impossible.



Oakland Brings Out Two-Passenger Coupe

A TWO-PASSENGER coupe of standard closed car construction has just been put on the market by the Oakland Motor Car Co. This car is priced at $1,285 f. o. b. Pontiac, Mich., and is mounted on the regular Oakland chassis. This coupe has been designed to complete the Oakland line with a light six-cylinder coupe and is built in accordance with regular coach making practice over a rigid frame work.

The body is designed exclusively for this coupe. Genuine leather and automobile cloth are used in the interior and plate glass for the windows. A feature of the body is the wide door opening on each side of the body. Lever operated windows are fitted for easy regulation of temperature in any weather. The doors have double latch catches with locks in the handles.

The seating arrangement permits the driver and passenger to sit side by side. The lower portion of the windshield is built stationary into the body to make it weather-proof, while the upper half is adjustable. A cowl ventilator is adjustable from the dash and there is a windshield visor. There is a large compartment under the rear deck for heavy luggage, with a deep, covered compartment back of the driver's seat to provide for smaller parcels. The instrument board is of walnut, with all instruments silver faced and glass covered. The steering wheel is of corrugated walnut with a nickel plated steering column. The standard equipment includes snubbers, visor, rear view mirror, windshield wiper and non-skid cord tires. The tire size is 32 by 4 in.

Committee to Recommend Uniform Motor Vehicle Law

New York, June 19—A committee representing the highway departments of 10 eastern states, which conferred here last week with committees from the National Automobile Chamber of Commerce and the Society of Automotive Engineers, probably will recommend endorsement of the uniform motor vehicle law at a general meeting of these highway departments at Baltimore, July 17. If the recommendation is adopted it will carry considerable weight with the legislatures of the 10 states. If the uniform law were adopted by most of these states it undoubtedly would be only a comparatively short time before the rest of the country swung into line.

Another question to be considered at Baltimore will be a uniform formula for rating trucks in these states.

Specifications of Current Motor Truck Models

NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES Front	TIRES Rear	Final Drive
Acason	¾-1	$1650a	3¾x5	34x5n	34x5n	W
Acason RB	1½	1950	3¾x5¼	36x3½	36x6	W
Acason H	2½	2750	4⅜x5⅝	36x4k	36x8k	W
Acason L	3½	3450	4⅜x5⅝	36x5k	36x10k	W
Acason M	5	4350	5 x6¼	36x6	40x12	W
Ace C	1½	2295	3¾x5½	34x3½k	34x5k	W
Ace A	2½	2795	4¼x5¼	36x4k	36x7	W
Acme 20	1	....	3¾x5	35x5n	35x5n	W
Acme 30	1½	....	3¾x5	34x3½	34x5	W
Acme 40	2	....	3¾x5	34x3½	34x5	W
Acme 60	3	....	4½x5¼	36x4	36x7	W
Acme 60L	3	....	4½x5½	36x4	36x7k	W
Acme 90	4½	....	4½x5½	36x5	40x10	W
Acme 125	6¼	....	4¾x6	36x6	40x12	W
American 25	2½	3350	4 x6	36x4k	36x4dk	W
American 40	4	4275	4½x6	36x5k	36x5dk	W
Armleder 20	1	2350	3¾x5¼	34x3½k	34x5k	W
Armleder 21	1½	2425	3¾x5¼	34x3½	34x6	W
Armleder 40	1½	2850	4½x5¼	34x3½	36x6	W
Armleder HW	2½	3200	4¼x5½	36x4k	36x7k	W
Armleder KW	3½	4150	4½x6	36x5	36x5d	W
Atlas MD	1	1185	3½x5	32x4½n	32x4½n	W
Atterbury 20R	1½	2475	3¾x5	34x3½	34x5	W
Atterbury 7CX	2½	3175	4½x5¼	36x4	36x4d	W
Atterbury 7D	3½	3975	4½x5½	36x5	40x5d	W
Atterbury 8E	5	4975	4¾x6	36x5	40x6d	W
Autocar 21UF	1½-2	1950	4¼x4½t	34x4k	34x5k	D
Autocar 21UG	1½-2	2050	4¼x4½t	34x4k	34x5k	D
Autocar 27H	2	2950	4 x5½	34x5	36x7	D
Autocar 27K2	2	3075	4 x5½	34x5	36x7k	D
Autocar 26Y	5	3950	4¼x5½	34x6	36x12	D
Autocar 26-B	5	4100	4¼x5½	34x6	36x12	D
Available H1½	1½	2475	1 x5	36x3½k	36x5k	W
Available H2	2	2775	1 x5	36x3½k	36x6k	W
Available H2½	2½	3160	1 x5	36x4k	36x8k	W
Available H3½	3½	4175	1½x5½	36x5	40x5d	W
Available H5	5	5375	5 x6	36x6	40x12	W
*Avery	1	....	3 x4s	34x5n	34x5n	I
Beck A Jr.	1	1850	3½x5	32x4½	33x5	I
Beck B-30	1½	2050	3¾x5	34x5	36x6	
Beck C-40	2	2150	3¾x5	36x6	36x6	
Beck D-50	2½	2850	4½x5¼	38x7	40x8	
*Bell (Penn.)	½	1000a	3½x5	31x4n	31x4n	B
Bell M (Iowa)	1	1495	3½x5½	35x5	35x5n	W
Bell E (Iowa)	1½	2100	3¾x5¼	34x3½	34x5	I
Bell O (Iowa)	2½	2550	4½x5½	34x4	34x6	I
Belmont A	½	725	3¾x4¼	31x4	31x4	B
Belmont D	2	2575	4¼x5½	34x3½k	34x6k	I
Belmont F	3	3500	4 x6	36x5k	36x5dk	I
Bessemer G	1	....	3½x5	35x5n	35x5n	I
Bessemer H-2	1½	....	3¾x5	36x3½	36x5	I
Bessemer J-2	2½	....	4¼x5¼	36x4	36x4d	I
Bessemer K-2	4	....	4½x5½	36x5	36x10	I
Bethlehem KN	1	1195	3½x5	34x4½n	35x5n	B
Bethlehem ON	2	1595	4 x6¼	34x4½n	34x6n	I
Bethlehem HN	3	2195	4 x5¼	36x4n	36x8n	I
Brinton C	1½	1500	3¾x5	34x4	34x5	W
Brinton D	2½	2250	4½x5¼	36x4	36x7	W
Brockway E	1	....	3¾x5½	35x5n	35x5n	B
Brockway S-5	1½	....	3¾x5	36x3½k	36x5k	W
Brockway SK	1½	....	4¼x5¼	36x4	36x6	W
Brockway KR	2½	....	4½x5½	36x4	36x8	W
Brockway K-5	2½	....	4½x5¼	36x4	36x8	W
Brockway RT	3½	....	4¾x6	36x5	36x10	W
Brockway R-4	3½	....	4½x5½	36x5	36x5d	W
Brockway T-4	5	....	4¾x6	36x6	40x6d	W
*Buick	...	945b	3½x4¾	31x4n	31x4n	B
Capitol G1½	1½	2975	3¾x5	35x5	38x7	W
Capitol H2½	2½	3700	4¼x6	36x4	36x8	W
Capitol K2½	2½	4250	4¼x6	36x6	42x9	W
Capitol M3½	3½	4425	4¼x6	36x5	36x10	W
Case	2	....	4½x5¾	36x6	38x7	I
*Chevrolet G	¾	745	3½x4	31x4n	34x4½n	B
*Chevrolet T	1	1125	3½x5¼	33x4n	35x5n	W
Chicago C1½	1½	....	4 x5	36x3½k	36x5k	W
Chicago C2½	2½	....	4 x5	36x4k	36x7k	W
Chicago C3½	3½	....	4½x5½	36x5	36x10	W
Chicago D5	5	....	4½x5½	36x6	40x12	W
Clydesdale 10	¾-1½	1485	3¾x5	34x5n	34x5n	B
Clydesdale 18	¾-1½	1890	3¾x5	34x5	34x5	W
Clydesdale 20	1-1½	2385	3¾x5	34x5	34x5k	W
Clydesdale 42	1½-2	2475	3¾x5	36x3½k	36x6	W
Clydesdale 65X	2½-3	3250	4½x5¼	36x4	36x8	W
Clydesdale 65EX	2½-3	3450	4½x5½	36x4	36x8	W
Clydesdale 90	3½-4½	4100	4½x5½	36x5	36x10	W
Clydesdale 120	5-6	4500	4¾x6	36x6	40x12	W
Columbia H	1½	1895	4 x5	35x5	38x7n	I
Columbia G	2½	2335	4 x5¼	36x4	36x7	I
Comet T	1½	1950	3¾x5	34x4	34x4	W
Commerce T	¾-1½	1450	3¾x5	34x4½n	34x4½n	B
Commerce 12	1½	1800	3¾x5	35x5n	35x5n	I
Commerce 16	2	2150	3¾x5	35x5n	36x6	I
Commerce 18	2½	2495	4½x5¼	36x6n	36x7n	I
Commerce 25	2½	2425	4½x5¼	36x4	36x7	W
Concord A	2	3150	4 x5½	36x3½k	36x6k	W
Concord B	3	3600	4¼x5½	36x4	36x8k	W
Concord AX	2	3250	4 x5½	36x3½	36x6	W
Concord BX	3	3600	4½x5½	36x4	36x8	W
Cook 51	2½	3600	4 x5⅛	36x6n	40x8n	W
Corbitt E-22	1	1480	3¾x5	34x3½	34x4	W
Corbitt D-22	1½	2200	3¾x5	34x3½	34x4	W
Corbitt C-22	2	2600	4½x5¼	36x3½	36x6	W
Corbitt B-22	2½	3000	4½x5¼	36x4	36x7	W
Corbitt R-22	¾	$3200	1½x5½	36x4	36x8	W
Corbitt A-22	3½-4	3800	4½x5½	36x5	36x10	W
Corbitt AA-22	5	4500	4¾x6	36x6	40x6d	W
Day-Elder AS	1	1600	3¾x5	35x5n	35x5n	W
Day-Elder B	1½	2000	3¾x5	34x3½	34x5	W
Day-Elder D	2	2400	4½x5¼	36x4	36x7	W
Day-Elder C	2½	2750	4¼x5½	36x4	36x7	W
Day-Elder F	3½	3150	4½x5½	30x5	36x5d	W
Day-Elder E	5	4250	4½x6	36x5k	40x6dk	W
Dearborn E	1	1600	3⅝x5¼	35x5n	35x5n	W
Dearborn FX	1½	2300	3¾x5⅛	34x4	34x5	W
Dearborn F	1½	2180	3¾x5⅛	34x4	34x5	W
Dearborn 48	2	2590	3¾x5⅛	34x4½n	34x7	W
Defiance G	1	1695a	3¾x5	35x5n	35x5n	B
Defiance D	1½	2095a	3¾x5	35x5n	36x6n	I
Defiance E	2	2275a	3¾x5	35x5n	38x7n	I
Denby 31	1¼	1485	3½x5	35x5n	35x5n	B
Denby 33	1½	2145	3¾x5	35x5n	38x7n	I
Denby 34	2	2395	3¾x5	36x3½	36x6	I
Denby 35	2½-3	2795	4½x5¼	36x4	36x7	I
Denby 27	4	3895	4½x5½	36x5	36x5d	I
Denby 210	5	4295	4½x5½	36x6	40x6d	I
Dependable A	¾-1	1650	3⅝x5⅛	34x5n	36x6n	W
Dependable C	2	2350	3¾x5¼	34x3½	34x5	W
Dependable D	2½	2650	4 x5½	34x5	36x6	W
Dependable E	3	2950	4¼x5½	36x4	36x7	W
Diamond T O-8	1-1¼	1975	3¾x5¼	36x3½n	36x4n	W
Diamond T T	1½	2250	3¾x5¼	36x3½	36x5	W
Diamond T U	2-2½	2650	4 x5¼	36x4	36x7	W
Diamond T K	3½	3750	4¼x5½	36x5	36x5d	W
Diamond T EL	5	4325	4½x5½	36x6	40x6d	W
Diamond T S	5	4500	4¾x6	36x6	40x6d	W
*Diehl A	1	....	3½x5	34x4½	35x5	I
Diehl B	1½	....	3½x5	36x6	36x6	I
Doane	2½	4100b	4¼x5¾	36x5	36x7	C
Doane	3½	5100b	4⅜x5¾	36x5	36x5d	C
Doane	6	6000b	5 x6¼	36x6	40x6d	C
*Dodge Brothers	½	730	3⅞x4½	32x4n	32x4n	B
Dorris K-4	2-2½	3400	4¼x5½	36x4	36x7	W
Dorris K-7	3½	4400	4¼x5½	36x5	36x10	B
*Dort	½	685a	3½x5	31x4n	31x4n	B
Double Drive B	3	4000	4¼x5½	6	6	W
Duplex A	2	2775	1 x5¼	35x5n	38x7n	W
Duplex E	3½	3500	4¼x5½	36x8	36x8	I
Duty 22	2	1590	3½x5	34x3½	34x5	I
Eagle 101	1½	1875	3⅝x5½	34x5	34x5	I
Eagle 100-2	2	2275	3¾x5¼	34x4k	34x7k	I
F. W. D. B	3	4200	4⅜x5½	36x6	36x6	B
Fageol 1½	1½	3000	3¾x5¼	34x3½k	34x6k	W
Fageol 2½	2½	3900	4¼x5¾	34x4	36x7	W
Fageol 3½	3½	5000	4½x6¼	36x5k	40x5dk	W
Fageol 5	5	5700	4½x6¼	36x6	40x6d	W
Fargo R	2	1700	3¾x5	36x4	36x6	I
Federal SD	1½	1800	3¾x5	35x5n	36x6n	W
Federal TE	1½	2175	4½x5¼	36x3½	36x5	W
Federal UE	2-2½	2425	4½x5¼	36x4	36x7	W
Federal WE	3½-4	3150	4½x5½	36x5	36x5d	W
Federal X2	5-6	4500	4⅜x6	36x6	40x6d	W
*Ford TT	1	430	3¾x4	30x3½n	32x4½n	W
Front Drive C	1½	2800	3¾x5½	5	4	W
G & J** 20	1	2275	3⅝x5⅛	34x5n	34x5n	W
G & J** A	2-2½	3375	4x5¼	36x4	36x7	W
G & J** B	3½-4	4475	4½x5½	36x5	36x10	W
G.M.C. K16	1	1295	3½x5½	34x5n	34x5n	B
G.M.C. K-41A	2	2375	4 x5½	36x4k	36x7k	W
G.M.C. K-41B	2	2375	4 x5½	36x4k	36x7k	W
G.M.C. K-71A	3½	3600	4½x6	36x5	40x5d	W
G.M.C. K-71B	3½	4050	4½x6	36x5	40x5d	W
G.M.C. K-101A	5	3950	4½x6	36x5	40x6d	W
G.M.C. K-101B	5	4450	4½x6	36x5	40x6d	W
G.W.W.	1½	1850	3¾x5½	35x5	35x5	I
*Garford 15	¾	1590	3¾x5½	34x5n	34x5n	W
Garford 25-B	1¼	1990	3¾x5½	36x6n	36x6n	W
Garford 70-H	2	2750	4¼x5½	36x4	36x7	W
Garford 77-D	3½	3750	4½x6	36x5	36x6d	W
Garford 68D	5	4500	5 x6½	36x6	40x6d	W
Garford 150-A	7½	5200	5½x6	36x6	40x7d	C
Gary F	1-1½	1675	3¾x5	36x3½	36x4	W
Gary I	2	2250	4 x5½	36x3½	36x6	W
Gary J	2½	2650	4¼x5½	36x4	36x8	W
Gary K	3½	3650	4½x6	36x5	40x5d	W
Gary M	5	4100	5 x6½	36x6	40x6d	W
Gersix M	1½	3100	4 x5½	36x3½	36x7	W
Gersix K	2½	3500	4½x5½	36x4	36x8	W
Gersix	3½	4500	4½x6	36x5	40x12	W
Graham Bros.	1	1265	3⅞x4½	33x4½n	34x5n	B
Graham Bros.	1½	1325	3⅞x4½	33x4½n	36x6n	B
1Gramm-Pion. 10	1	1365	3½x5	33x5n	33x5n	B
1Gramm-Pion. 15	1½	1900a	3¾x5	36x3½k	36x5k	I
1Gramm-Pion. 65	1½	2500a	3¾x5	36x3½k	36x5	W
1Gramm-Pion. 20	2	2925a	4½x5¼	36x4k	36x7k	W
1Gramm-Pion. 30	3	3275a	4¼x5½	36x4k	36x4dk	W
1Gramm-Pion. 75P	3½	$4225a	4½x5½	36x6n	42x9n	W
1Gramm-Pion. 40	4	3995a	4½x5½	36x5	36x5dk	W
1Gramm-Pion. 50	5-6	4895a	4¾x6	36x6	40x6dk	W
Hahn B2	1	....	3½x5	34x5k	34x5k	W
Hahn O	1½	....	3¾x5¼	36x3½k	36x6k	W
Hahn K	2	....	4½x5½	36x7k	36x8k	W
Hahn L	3	....	4½x5½	36x5k	36x8k	W
Hahn M	5	....	4½x5½	36x5	36x10	W
Hahn N	6	....	4¾x6	36x6	40x12	W
Hal-Fur E	1½	2350	4x5½	34x5n	38x7n	W
Hal-Fur B	2½	3000	4¼x5½	36x6n	36x8	W
Hal-Fur F	3½	4000	4½x5½	36x6n	40x10	W
Hall 1½	1½	3100	3¾x5	34x5n	38x7n	W
Hall 2½	2½	3275	4⅛x5¼	36x4	36x6	W
Hall 3½	3½	4100	4½x5½	36x5	36x5d	W
Hall 5	5	5100	4½x5½	36x5	40x6d	W
Hall 7 chain	7	5100	4½x5½	36x5	40x6d	C
Harvey WOA	2	2650	4¼x5½	34x4	34x7	W
Harvey WFA	2½	2950	4¼x5½	36x4	36x7	W
Harvey WHA	3½	3950	4½x6	36x5	36x5d	W
Hawkeye K	1½	1850	3¾x5½	34x3½k	34x5k	I
Hawkeye M	2	2650	4¼x5	36x4k	36x6k	I
Hawkeye N	3½	3700	4½x6⅜	36x5k	36x10k	I
Hendrickson O	1½	2200	3⅝x5⅛	36x4n	36x5n	W
Hendrickson N	2½	2690	4¼x5¾	36x4k	36x7k	W
Hendrickson M	3½	3000	4¼x5	36x5k	36x5dk	W
Hendrickson K	5	4000	5 x6¼	36x6	40x6	W
Hurlburt A	1½	2850	4 x5½	34x4	34x5	W
Hurlburt B	2½	3750	4¼x5½	36x4	36x4d	W
Hurlburt C	3½	4590	4½x6	36x5	36x5d	W
Hurlburt D	5	5500	4½x6	36x5	40x6d	W
Indep'd't(Iowa), B	1	1665	3½x5	34x3½	34x4	I
Indep'd't(Iowa). G	1½	2040	3¾x5¼	34x3½	34x5	I
Indep'd't(Ia.) HI	2½	2940	4¼x5¼	36x4	36x4	I
Indep'd't(Ohio). F	1½	2385	3¾x5	36x3½	36x5	W
Indep'd't(Ohio) H	2½	3085	4¼x5¼	36x4	36x4d	W
Indep'd't(Ohio) K	3½	3985	4½x5½	36x5	36x5d	W
Indiana 12	1½	....	3¾x5¼	34x3½k	34x5k	W
Indiana 20	2	....	4½x5½	36x4k	36x7k	W
Indiana 25	2½	....	4½x5½	36x4k	36x8k	W
Indiana 35	3½	....	4⅜x5½	36x5k	36x5dk	W
Indiana 51	5	....	5 x6¼	36x5k	40x6dk	W
*International S	¾	1500	3½x5	34x5n	34x5n	I
International 21	1	1750	3½x5¼	36x3½	36x3½	I
International 31	1½	1850	3½x5¼	36x3½	36x4	I
International 41	2	2100	3½x5¼	36x3½	36x5	I
International 61	3	2400	4¼x5	36x4	36x6	I
International 101	5	3600	4¼x5	36x5	40x10	I
Jackson 4WD	3½	3850	4½x5½	36x7	36x7	B
Jumbo 15	1½	2295	3¾x5¼	36x3½	36x5	I
Jumbo 20	2	2520	3¾x5¼	35x5n	38x7n	I
Jumbo 25	2½	2660	4½x5½	36x4	36x7	I
Jumbo 30	3	3060	4¼x5½	36x6n	42x9n	I
Jumbo 35	3½	3900	4½x6	36x5	36x10n	I
Jumbo 40	4	4400	4½x6	38x7n	44x10	I
K-Z 1	1	1750	3½x5	34x3½	34x5	W
K-Z 1½	1½	2075	3¾x5	36x4	36x6	W
K-Z 2½	2½	2550	4½x5¼	36x4	36x8	W
K-Z 3½	3½	3350	4½x5½	36x5	40x10	W
K-Z 5	5	3850	4½x5½	36x6	40x6d	W
Kalamazoo T	1	1295	4 x5	34x5	34x5n	B
Kalamazoo G-1	1½	2495	3¾x5	34x4	34x5	W
Kalamazoo LG	2	2645	4 x5	36x4	36x7	W
Kalamazoo NH	3	3145	4 x6	36x5	36x10	W
Kalamazoo HD	3	3350	4½x6	36x5	36x10	W
Kalamazoo LK	4	3845	4½x6	36x5	36x12	W
Kalamazoo OK	5	4350	4½x6	36x6	40x6d	W
*Kearns H	1	1150	3½x5	32x4½n	32x4½n	I
Kearns N	2	1650	4 x5	34x3½	34x6	I
2Kelly-S K-31	1½	2700	3¾x5¼	36x3½	36x6	C
2Kelly-S K-34	1½	2700	3¾x5¼	36x3½	36x6	W
2Kelly-S K-38	2½	2900	3¾x5¼	36x4	36x4d	W
2Kelly-S K-35	2½	2900	3¾x5¼	36x4	36x4d	C
2Kelly-S K-40	3½	3900	4½x6½	36x5	40x5d	C
2Kelly-S K-41	3½	3900	4½x6½	36x5	36x10	I
2Kelly-S K-42	3½	3900	4½x6½	36x5	40x5d	W
2Kelly-S K-50	5	4400	4½x6½	36x6	40x6d	C
2Kelly-S K-60	6	4600	4½x6½	36x6	40x7d	C
Keystone 40	2	2175	3¾x5⅛	34x5n	38x7n	I
Kimball AB	2	3675	4 x6	36x4	36x7	W
Kimball AC	2½	3975	4¼x6	36x4	36x8	W
Kimball AK	3	4500	4½x6	36x4	36x10	W
Kimball AE	4	5000	4¾x6	36x5	40x12	W
Kimball AF	5	5500	5 x6	36x6	40x7d	W
*Kissel Express	1	1595	3⅞x5½	34x5n	34x5n	W
Kissel Utility	1½	1975	3⅞x5½	36x3½	36x5	W
Kissel Freighter	2½	2875	4¼x5½	36x4	36x7	W
Kissel H. D.	4	3675	4¼x5½	36x5	36x5d	W
Kleiber AA	1	2200	4½x5¼	34x3½k	34x5k	W
Kleiber A	1½	3100	4½x5¼	36x3½k	36x6k	W
Kleiber BB	2	3600	4½x5¼	36x4k	36x7k	W
Kleiber B	2½	3950	4½x5½	36x5k	36x8	W
Kleiber C	3½	4600	4½x5½	36x5	36x5d	W
Kleiber D	5	5300	5 x6½	36x6	40x12	W
Koehler D	1½	2150	3½x5	34x3½	34x5	W
Koehler M	2½	3175	4 x5½	36x4	36x7	W
Koehler MCS	2½	3275	4 x5⅛	36x4	36x7	W

FINAL DRIVE:—B—Bevel, C—Chain, D—Double Reduction, I—Internal Gear, W—Worm.
r—8 cyl. s—6 cyl. t—2 cyl.—all others are 4 cyl.
d—dual tires. k—pneumatic tires optional at extra cost. n—pneumatic tires. a—price includes several items of equipment. b—price includes body. *—speed truck or delivery wagon. **—Canadian Make. trac.—tractor.

1—Gramm-Pioneer. 2—Kelly-Springfield.

Specifications of Current Motor Truck Models—Continued

NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES Front	TIRES Rear	Final Drive
Koehler.....F	3½	$4470	4½x5½	36x5	36x10	W
Koehler,MT. Trac	5	3275	4 x5⅛	36x4	36x7	W
Krebs-Collier..23	¾	1260	3¾x5	34x4½	34x4½	B
Krebs-Collier..24	1	1555	3¾x5	34x5	34x5	W
Krebs-Collier..45	1½	2125	4½x5½	36x4	36x7	W
Krebs-Collier..75	2½	2375	4½x5½	36x4	36x8	W
Krebs-Collier.110	3½	2975	4½x5½	36x5	40x10	W
Larrabee.....X-2	1	1925	3¼x4½	34x5n	34x5n	B
Larrabee.....U	1½	2400	3¾x5	34x3½	34x5	W
Larrabee.....J	1½-2½	2400	3¾x5	34x3½k	34x5k	W
Larrabee.....K	2½	3100	4⅛x5¼	36x4	36x7	W
Larrabee.....K-5	2½-3	3450	4½x5½	36x4	36x8	W
Larrabee.....L-4	3½	4000	4½x5½	36x5	36x5d	W
Larrabee.....W	5	4800	4¾x6	36x6	40x6d	W
Maccar.....L	1½	2700	4½x5½	36x4	36x6	W
Maccar.....H-A	2	3400	4½x5¼	36x4	36x4d	W
Maccar.....H-2	3	3100	4½x5½	36x4	36x5d	W
Maccar.....H-3	4	4200	4½x5½	36x5	36x6d	W
Maccar.....G	5-6	4950	4¾x6	36x5	40x6d	W
MacDonald.....A	7½	5750	4½x6	40x7	40x14	I
Mack...AB D.R.	1½	3150	4 x5	36x4	36x3½d	D
Mack...AB Chain	1½	3000	4 x5	36x4	36x3½d	C
Mack...AB Chain	2	3300	4 x5	36x4	36x4d	C
Mack...AB D.R.	2	3750	4 x5	36x4	36x4d	D
Mack...AB D.R.	2½	3850	4 x5	36x4	36x4d	D
Mack...AB Chain	2½	3100	4 x5	36x4	36x4d	C
Mack...AC Chain	3½	4950	5 x6	36x5	40x5d	C
Mack...AC Chain	5	5500	5 x6	36x6	40x6d	C
Mack...AC Chain	6½	5750	5 x6	36x6	40x12	C
Mack...AC Chain	7½	6000	5 x6	36x7	40x7d	C
Mack Trac....AB	5	3400	4 x5	36x4	36x4d	C
Mack Trac....AC	7	4950	5 x6	36x5	40x5d	C
Mack Trac....AC	10	5500	5 x6	36x6	40x6d	C
Mack Trac....AC	13	5750	5 x6	36x6	40x12	C
Mack Trac....AC	15	6000	5 x6	36x7	40x7d	C
Mapleleaf...AA**	2	3775	4 x5¼	36x4	36x7	W
Mapleleaf...BB**	3	4350	4¼x5½	36x4	36x4d	W
Mapleleaf...CC**	4	5100	4½x5½	36x5	36x5d	W
Mapleleaf..DD**	5	6200	4½x5½	36x6	40x6d	W
Master.....JW	1½	2200	4½x5½	34x3½	34x5	W
Master.....JD	1½	2590	4½x5½	34x3½	34x5	D
Master.....Z	2	2290	4½x5½	34x3½	34x5	W
Master.....W	2½	2890	4½x5½	34x4	36x7	W
Master.....DD	2½	3190	4¼x5½	34x4	36x7	D
Master.....A	3½	3990	4½x6	36x5	40x5d	W
Master.....E	3½	4290	4½x6	36x5	40x5d	D
Master.....Y	4	4490	4½x6	36x5	40x6d	D
Master.....B	5	4990	4¾x6½	36x6	40x6d	W
Master.....F	5	5090	4¾x6½	36x6	40x6d	D
MasterTrac,.DDT	6	3390	4¼x5½	34x4	36x7	D
*Maxwell.....1½	1½	932	3⅝x4½	32x3n	32x4n	W
Menominee...HT	1-1¼	2000	3¾x5	34x3½	36x5	W
Menominee....H	1½	2175	4 x5	36x3½	36x5	W
Menominee....D	2-2½	2875	4 x6	36x4	36x8	W
Menominee....G	3½	3800	4½x6	36x5	36x10	W
Menominee...J-3	5	4250	4¾x6	36x6	40x12	W
Moline.....10	1½	1985	3½x5	34x5n	36x6n	I
3Moreland..R. R.	1	1595	4 x5	34x5n	34x5n	B
Moreland.....BX	1½	1930	4 x5	36x3½	36x6k	W
Moreland.....EX	2	2800	4½x5¼	36x4	36x7k	W
Moreland.....AX	3	3500	4½x5½	36x5	38x10k	W
Moreland.....RX	1½-5	4600	4¾x6	36x6	40x6	W
Napoleon.....7	¾	1350	3½x5	33x4	33x4n	I
Napoleon.....9	1	1535	3½x5	35x5k	35x5k	I
Napoleon.....11	1½	1860	3½x5	35x5k	36x6k	I
Nash.....2018	1-1½	1595	3¾x5¼	35x5	36x6	I
Nash.....3018	2-2½	2150	3¾x5¼	36x6	40x8	I
Nash.....Quad	2-2½	2750	4¼x5½	40x8	40x8	I
Nash .3018, LWB	2-2½	2200	3¾x5¾	36x6	40x8	I
Nash Quad. LWB	2-2½	2800	4¼x5½	40x8	40x8	I
Nash.....5018	2½	2250	3¾x5¼	34x4	34x6	I
4Nelson.....G2	1½	....	4⅛x5¼	36x3½	36x6	W
4Nelson.....G3	2½	....	4⅛x5¼	36x4	36x7	W
4Nelson.....G4	3½	....	4½x5½	36x5	36x5d	W
4Nelson.....G5	5	....	4¾x6	36x6	40x6d	W
Netco.....2DR	3100	1½x5¼	36x4k	36x7k	W
Netco.....HL	2½	3500	4½x5½	36x4k	36x8k	W
New York.....M	1½	....	4⅛x5¼	36x3½	36x5	W
New York.....N	2-2½	....	4½x5¼	36x4	36x4d	W
Niles.....E	2	3000	4½x5¼	36x4k	36x7k	W
Noble.....B30	1½	....	3¾x5¼	36x3½	36x5	W
Noble.....C40	2	....	4 x5½	36x4	36x7	W
Noble.....D50	2½	....	4¼x5½	36x4	36x8	W
Noble.....E70	3½	....	4½x6	36x5	36x10	W
Northwestern..W	1½	2700	4½x5¼	34x4	36x6	W
Northwestern.WS	2½	3500	4½x5½	36x4	36x8	W
Norwalk.....25E	1	1595	3½x5	34x3½	34x4	W
Norwalk.....35E	1½	1925	3½x5	34x3½	34x3½d	W
Norwalk,35E.Spec	1½	2285	3¾x5¼	34x3½	34x5	W
O. K.....K1	1½	2450	4 x5½	36x3½	36x5	W
O. K.....L1	2½	3250	4¼x5½	36x4	36x8	W
O. K.....M1	3½	4250	4½x6	36x5	36x5d	W
Ogden.....A2	1	....	3½x5	34x5n	34x5n	W
Ogden.....D	1½	....	3¾x5	36x3½	36x5	W
Ogden.....E	2½	....	4½x5¼	36x4	36x8	W
Old Hickory...W	1	1775	3¾x5	36x3½k	36x4k	W
Old Reliable....A	1½	2350	4 x5	34x4	36x6	W
Old Reliable....B	2½	$3500	4¼x6	34x4	36x4d	W
Old Reliable....C	3½	4250	4¼x6	36x5	36x5d	W
Old Reliable....D	5	5250	4¾x6	36x6	40x6d	W
Old ReliableKLM	7	6000	4¾x6¼	36x6	40x7d	C
*Oldsmobile Econ	1	1095	3½x5¼	35x5n	35x5n	I
Olympic.....A	2½	3200	4¼x5½	36x4	36x8	W
Oshkosh.....A	2	3250	3½x5	36x6n	36x6n	B
Oshkosh.....AA	2	3400	3½x5	36x6n	36x6n	B
Oshkosh.....B	2½	3850	4 x5⅛	38x7n	38x7n	B
Oshkosh.....BB	2½	4000	4 x5⅛	38x7n	38x7n	B
*Overland.....4	½	450	3⅜x4	30x3½n	30x3½n	B
Packard.....EC	1½-3	3100	4⅛x5½	36x4	36x7	W
Packard.....EX	1½-3	3100	4⅛x5½	36x6n	40x8n	W
Packard.....ED	2-4½	4100	4½x5½	36x5	36x5d	W
Packard.....EF	4-7½	4500	5 x5½	36x6	40x6d	W
Paige.....52-19	1½	1950	4 x5¼	34x3½	34x5	W
Paige.....54-20	2½	2420	4¼x5½	34x4	34x8	W
Paige.....51-19	3½	3145	4½x5½	36x5	36x5d	W
Parker.....C-22	1	1875	3¾x5¼	34x5n	34x5n	W
Parker.....G-22	2½	3200	4¼x6	34x4	36x4d	W
Parker.....J-20	3½	3950	4½x6	36x5	40x5d	W
Parker.....M-20	5	4850	5 x6	36x6	40x6d	W
Patriot... Revere	1	1380	3¾x5	35x5n	35x5n	W
Patriot... Lincoln	2	2050	4 x5¼	34x3½	34x5	W
Patriot .Washgt'n	3	2900	4½x5½	36x4	36x7	W
Pierce-Arrow....	2	3200	4 x5½	36x4	36x4d	W
Pierce-Arrow....	3½	4350	4½x6¾	36x5	36x5d	W
Pierce-Arrow....	5	4850	4½x6¾	36x5	40x6d	W
Pittsburgher.....	1½-2	3000	3⅝x5	36x4	36x6	..
Pittsburgher.....	3	3800	4½x5½	36x5k	36x8	W
Power.....F	2	3150	3¾x5½	36x5	36x7	W
Power.....C	3½	4250	4¼x5½	36x5	40x10	W
Rainier.....R-21	¾	....	3½x5	35x5n	35x5n	W
Rainier.....R-29	1	....	3¾x5	34x3½	34x4	W
Rainier.....R-26	1½	....	3¾x5	34x3½	34x5	W
Rainier.....R-28	2	....	4⅛x5¼	34x4	34x6	W
Rainier.....R-20	2½-3	....	4⅛x5¼	34x4	34x7	W
Rainier.....R-15	3½-5	....	4½x5½	36x5	36x5d	W
Rainier.....R-17	5-6	....	4¾x6	36x6	40x6d	W
Ranger..TK-20-2	1½	2450	3¾x5	36x6n	38x7n	W
*Reo.....F	¾-1¼	1245	4½x4½	31x4½n	34x4½n	B
Reliance.....10A	1½	2100	4 x5½	36x3½	36x5	I
Reliance.....20B	2½	3100	4¼x5½	36x4	36x4d	I
Republic.....75	¾	1395b	3½x5	32x4½n	32x4½n	I
Republic.....10	1	1395	3¾x5	34x3	34x4	I
Republic..10 Exp	1	1695	3¾x5	35x5n	34x5n	I
Republic.....11X	1½	1795	3¾x5	34x3½	34x6	I
Republic.....19	2½	2195	4½x5½	36x4	36x7	I
Republic.....20	3½	3095	4½x5½	36x5	36x10	I
Rowe.....CW	1½	3000	3¾x5	36x6n	36x6n	W
Rowe....C.D.W.	2	3300	4 x5	34x4	36x3½d	W
Rowe....G.S.W.	3	4150	4 x6	34x5	36x5d	W
Rowe....G.P.W.	3	5250	3¼x5r	38x7n	42x9n	W
Rowe.....HW	4	4500	4¼x6	36x5	36x6d	W
Rowe.....F. W.	5	5500	4½x6	36x6	40x6d	W
Ruggles.....20	1	1195	3¾x5	34x5n	34x5n	B
Ruggles.....40	2	1795	4 x5	34x5n	34x7	D
Sanford W-15	1½	2150b	3¾x5	36x3½k	36x5k	..
Sanford.....25	2½	....	4½x5¼	36x4	36x4d	W
Sanford.....35	3½	....	4½x5½	36x5	36x5d	W
Sanford.....50	5	....	4¾x6	36x5	40x6d	W
Schacht....2-Ton	2	3200	4¼x5½	36x4	36x7	W
Schacht....3-Ton	3	3800	4¼x5½	36x5	36x5d	W
Schacht....4-Ton	4	4200	4½x6	36x5	40x5d	W
Schacht....5-Ton	5	4400	4½x6	36x5	40x6d	W
Schacht....7-Ton	7	5050	4½x6	36x6	40x7d	W
Schwartz.....A	1	1685	3½x5	34x4½n	34x4½n	B
Schwartz.....K	2	3300	3¾x5¼	34x3½	34x7	W
Schwartz.....L	3	3600	4¼x5½	36x4	36x8	W
Schwartz.....M	5	4900	4½x6	36x6	40x12	W
Selden.....30	1½	2250	3¾x5	34x3½	34x5	W
Selden.....31	1½-2½	3350	4⅛x5¼	34x5	38x7	W
Selden.....50	2½	3250	4⅛x5¼	36x4	36x7	W
Selden.....51	2½-3½	4350	4½x5½	36x6n	40x8n	W
Selden.....70	3½-5	3750	4½x5½	36x5	36x10	W
Selden.....90	5-7	4950	4¾x6	36x6	40x12	W
Seneca.....M	½	820	3½x4½	30x3½n	30x3½n	B
*Service.....12	¾	....	3½x4½	32x4½n	32x4½n	B
*Service.....15	1½	....	3½x5	31x4½n	35x5n	B
Service.....2t	1½	....	3½x5⅛	34x3½	34x5	W
Service.....32	2	....	4 x5½	36x3½	36x7	W
Service.....37	2	....	4¼x5½	35x5n	38x7n	W
Service.....52	3	....	4¼x5½	36x4	36x8	W
Service.....72	3½	....	4¼x5½	36x5	36x5d	W
Service.....77	4	....	4½x6	36x5	36x5d	W
Service.....102	6	....	4½x6	36x6	40x6d	W
Signal.....RY	1	1950	3¾x5	34x5n	36x6n	W
Signal.....H	1½	2450	4¼x5¼	34x4	36x6	W
Signal.....J	2½	2875	4½x5¼	34x4	36x8	W
Signal.....M	3½	3675	4½x5½	36x5	40x5d	W
Signal.....R	5	$4400	4¾x6	36x6	40x6d	W
Southern.....10	1	2090	3¾x5	34x3½	34x4	W
Southern.....15	1½	2590	3¾x5½	36x6n	34x4	W
Southern.....20	2	2990	4¾x5¼	36x6n	40x8k	W
Standard.....1-K	1½	1600	3¾x5	34x3½k	34x5k	W
Standard.....76	2½-3	2400	4½x5¼	36x4k	36x7k	W
Standard.....66	3½-5	3150	4½x5½	36x5	36x10	W
Standard.....5-K	5-7	4400	4¾x6	36x6	40x12	W
Sterling.....1½	1½	2885	4 x5¾	36x3½k	36x5k	W
Sterling.....2	2	3085	4 x5¾	36x4k	36x6k	W
Sterling.....2½	2½	3290	4⅜x5¾	36x4k	36x4dk	W
Sterling.....3½	3½	4325	4½x6¼	36x5k	40x5dk	W
Sterling.....5-W	5	4950	5 x6¼	36x6	40x6d	W
Sterling.....5-C	5	5500	5 x6¼	36x6	40x6d	C
Sterling.....7½	7½	6000	5 x6¼	36x6	40x7d	C
*Stewart.....14	¼-1½	1245	3⅝x5⅛	34x4½n	34x4½n	I
Stewart.....15	1½-1½	1445	3⅝x5⅛	35x5n	35x5n	I
Stewart.....9	1½-2	1790	3¾x5	34x3½	34x5	I
Stewart.....7	2-2½	2190	4½x5¼	34x4	34x7	I
Stewart.....7-X	2½-3	2390	4¼x5½	34x4	34x7	I
Stewart.....10	3½-4	3190	4½x5½	36x5	36x5d	I
Stewart.....10-X	3½-4	3190	4½x6	36x5	36x5d	I
*Stoughton.....C	¾	1240	3½x5	34x4½n	34x4½n	W
Stoughton.....A	1	1790	3¾x5¼	34x5	34x5	W
Stoughton.....B	1½	2150	3¾x5½	36x3½	36x5	W
Stoughton.....D	2	2490	4 x5½	36x4	36x7	W
Stoughton.....F	3	3150	4¼x5½	36x5d	36x5d	W
Sullivan.....E	2	2800	4½x5½	36x4k	36x7k	W
Sullivan.....H	3½	3750	4½x6	36x5	36x5d	W
*Thomart.....	1¼	1795a	4 x5¼	34x5	34x5	C
Tiffin.....GW	1½	2100	4½x5¼	36x3½	36x5	W
Tiffin.....MW	2½	2700	4½x5½	36x4	36x3½d	W
Tiffin.....PW	3½	3600	4½x5½	36x5	40x5d	W
Tiffin.....F50	5	4300	4¾x6	36x6	40x6d	W
Tiffin.....F60	6	4500	4¾x6	36x6	40x12	W
Titan.....	2	2750	4 x5	36x4k	36x7k	D
Titan.....	2½	2950	4¼x5½	36x4k	36x8k	D
Titan.....	3½	3950	4½x6	36x5k	40x10k	D
Titan.....	5	4550	4½x6	36x5	40x12	D
Tower.....J	1½	2900	4½x5¼	35x5	38x7	W
Tower.....H	2½	3200	4½x5¼	36x4	36x7	W
Tower.....G	3½	4100	4½x5½	36x5	36x5d	W
Traffic.....	1½	1595	3¾x5	35x5n	35x5n	I
Traffic.....C	2	1595	3¾x5	34x3½k	34x5k	I
Traffic.....	3	1895	3¾x5	36x4	36x7	I
*Transport.....15	1	1295a	3¾x5	32x4½n	32x4½n	B
Transport.....25	1½	1495	3¾x5½	34x3½k	34x4k	I
Transport.....35	2	1885	3¾x5	36x3½k	36x6k	I
Transport.....55	3	2385	4½x5½	36x4k	36x8k	I
Transport.....60	3½	2585	4¼x5½	36x4k	36x8k	I
Transport.....75	5	3485	4½x6	36x5k	36x12k	I
Traylor.....B	1½	2390	3¾x5½	34x3½	34x5	W
Traylor.....C	2-2½	2850	4 x5½	36x4	36x7	W
Traylor.....D	3-3½	2300	4¼x5½	36x4	36x8k	W
Traylor.....F	5-6	4700	4½x6	36x6	40x6d	W
*Triangle.....AA	1	1285	3¼x5	34x4½n	34x4½n	I
Triangle.....A	1½-2	1985	3¾x5½	34x3½k	34x6k	I
Triangle.....C	2-2½	2285	3¾x5½	36x4k	36x6k	I
Triangle.....B	2½-3	2585	4 x5¾	36x4k	36x7k	I
Triumph.....G	1	1995	3⅝x5½	34x5n	34x5n	W
Triumph.....HC	1½	2550	3¾x5½	36x3½	36x5	W
Triumph.....HB	2	2900	3¾x5½	36x4	36x7	W
Twin City...B.W.	2	2750	4 x5½	36x6	40x8	I
Twin City...A.W.	3½	3950	4½x6	36x5	40x5d	W
5Twin City.....B	3½	....	5½x6	36x6	36x6	I
5Twin City.....A	5	....	5½x6	36x7	36x7	I
Ultimate.....A	2	3150	4 x5½	36x3½	36x6	W
Ultimate.....AJ	2	3200	4¼x5½	36x3½	36x6	W
Ultimate.....AJL	2	3250	4¼x5⅝	36x3½	36x6	W
Ultimate.....B	3	3700	4¼x5½	36x4	36x4d	W
Ultimate.....BL	3	3800	4¼x5½	36x4	36x4d	W
Ultimate.....D	5	5500	5 x6½	36x6	40x12	W
Union.....FW	2½	3190	4 x6	36x5k	36x8k	D
Union.....HW	4	4650	4½x6	36x6	40x12	D
Union.....JW	6	5800	5 x6	36x6	40x14	D
United.....A	1½	2445	3¾x5¼	36x3½k	34x5k	W
United.....B	2½	3150	4¼x5½	36x4k	36x7k	W
United.....C	3½	3975	4¼x5½	36x5	36x5d	W
United.....V	5	4500	4½x6	36x6	40x6d	W
*United States..U	1	1875	3⅝x5½	34x5n	34x5n	B
UnitedStates,NW	1½	2225	3¾x5	36x5	36x3½	W
United States...N	1½	1975	3¾x5	36x3½k	36x5k	I
United States...R	3	3075	4 x5¼	36x4	36x4d	W
United States...S	4	3875	4½x5½	36x5	36x5d	W
United States...T	6	4850	4¾x6½	36x6	40x6d	W
Velie.....46	1½	1585	3¾x5	36x3½k	36x5k	I
Veteran.....M**	1½	2699	3¾x5¼	35x5n	35x5n	W
Veteran.....P**	2	3699	4¼x5½	36x4	36x7	W
Veteran.....R**	3	4200	4¼x5½	36x4	36x7	W
Veteran.....S**	4	5395	4½x6	36x5	36x10	W
*Vim.....29	½	1050	3⅛x4½	31x4n	31x4n	W
Vim.....30	½	1175	3½x4½	32x4½	32x4½	W
Vim.....31	1	1975	3¾x5⅛	35x5n	35x5n	W
Vim.....22	2	3150	3¾x5½	36x4	36x6	W
Vim.....23	3	3950	4¼x5½	36x5	36x5d	W
Walker-JohnsonA	2	2250	3¾x5	34x3½	34x6	W
Walker-JohnsonB	3	2750	4¼x5½	36x4	36x8	W

FINAL DRIVE:—B—Bevel, C—Chain, D—Double Reduction, I—Internal Gear, W—Worm.
r—8 cyl. s—6 cyl. t—2 cyl.—all others are 4 cyl. d—dual tires. k—pneumatic tires optional at extra cost. n—pneumatic tires. a—price includes several items of equipment. b—price includes body. *—speed truck or delivery wagon. **—Canadian Make. trac.—tractor.

3—Moreland Road Runner. 4—Nelson Le Moon. 5—Twin City Four Wheel Drive.

Specifications of Current Motor Truck Models—Continued

NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES Front	TIRES Rear	Final Drive
Walter.....S	5	$4850	4½x6¼	36x6	40x6d	W
Ward-LaF.....2B	2½	2990	4⅜x5¾	36x4	36x4d	W
Ward-LaF.....4A	3½	3990	4½x6¼	36x5	36x5d	W
Ward-LaF.....5A	5	4590	5 x6¼	36x6	40x6d	W
*Watson.....B	1	1865a	3¾x5¼	35x5n	35x5n	W
Watson.....N	3½	4250	4½x5½	36x5	36x10	W
Western....W1½	1½	2550	4½x5¼	36x3½k	36x5k	W
Western....L1½	1½	2550	3¾x5	36x3½k	36x5k	W
Western....W2½	2½	3250	4½x5¼	36x4	36x7	W
Western....L2½	2½	3250	4¼x6	36x4	36x7	W
Western....W3½	3½	4250	4½x6	36x5	40x5d	W
*White.....15	¾	2400	3¾x5¼	34x5n	34x5n	B
White.....20	2	3250	3¾x5½	36x4k	36x7	D
White.....40	3½	4200	3¾x5¾	36x5	40x5d	D
White.....45	5	4500	4¼x5¾	36x6	40x6d	D
White Hick.....E	1	1225	3¾x5	34x5n	34x5n	W
White Hick....H	1½	1375	3¾x5	36x3½	36x5	W
White Hick....K	2½	1675	4⅛x5¼	36x4	36x5	W
Wichita.....K	1	$1875	3¾x5¼	36x3½	36x4k	W
Wichita.....M	2	2400	3¾x5¼	36x3½k	36x6k	W
Wichita.....RX	3	3200	4½x5¾	36x4k	36x8k	W
Wichita.....O	4	3500	4½x6¼	36x5k	36x5k	W
Wilcox.....AA	1	1900	3¾x5½	36x4k	36x4k	W
Wilcox.....BB	1½	2550	4¼x5	36x4	36x5	W
Wilcox.....D	2½	3000	4¼x5	36x4k	36x3½dkW	
Wilcox.....E	3½	3950	4½x6	36x5k	36x5dk	W
Wilcox.....F	5	$4350	4¾x6½	36x5	40x6d	W
Wilson.....F	1½	2270	3¾x5	36x3½	36x5	W
Wilson.....EA	2½	2825	4½x5¼	36x4	36x7	W
Wilson.....G	3½	3685	4½x5½	36x5	36x5	W
Wilson.....H	5	4520	4¾x6	36x6	40x6	W
*Wisconsin.....A	1	1750	3¾x5	34x5n	34x5n	W,B
Wisconsin.....B	1½	2100	3¾x5	35x5	36x6	W
Wisconsin.....C	2½	2700	4 x5¾	36x6n	36x7	W
Wisconsin.....D	3½	3000	4¾x5¾	36x6n	40x8	W
Wisconsin.....E	5	3500	4½x6¼	36x6	36x10	W
Wisconsin.....F	7	4000	5 x6¼	36x6	36x12	W
Witt-Will.....N	1½	2250	3¾x5	36x3½k	36x5k	W
Witt-Will.....P	2½	2750	4½x5¼	36x3½k	36x7k	W
Wolverine.....J	1	2125	3½x5	34x3	34x4	I
Wolverine.....J	1½	2375	3¾x5	34x3½	34x5	I
Wolverine.....J	2	2640	3¾x5	34x4	34x7	I
Wolverine.....J	2½	3425	4½x5¼	36x5	36x10	I
Wolverine.....L	3½	4100	4½x5½	36x5	36x10	I

FINAL DRIVE:—B—Bevel, C—Chain, D—Double Reduction, I—Internal Gear, W—Worm. r—8 cyl. s—6 cyl. t—2 cyl.—all others are 4 cyl. d—dual tires. k—pneumatic tires optional at extra cost. n—pneumatic tires. a—price icludes several items of equipment. b—price includes body. *—speed truck or delivery wagon. **—Canadian Make. trac—tractor.

Specifications of Current Farm Tractor Models

TRADE NAME	Rating	Price	Wheels or Crawlers	Engine	Cylinders: Bore, Stroke	Fuel	Plow Capacity
Allis-Chal.G.P	6-12	$250	2	LeR.	4-3⅛x4½	Gas.	1
Allis-Chalm..B	6-12	325	2	LeR.	4-3⅛x4½	G	1
Allis-Chalm...	15-25	1185	4	Midw.	4-4½x5¼	Gas.	3
Allis-Chalm...	20-35	1885	4	Own	4-4¾x6½	GorK	3-4
‡Allis-Chalm..	20-35	2085	4	Own	4-4¾x6½	G	4
Allwork...2-G	14-28	1095	4	Own	4-4¾x6	GorK	3
Allwork....C	14-28	1395	4	Own	4-5 x6	GorK	3
AndrewsKin.D	18-36	2500	4	Clim.	4-5 x6½	GorK	4
ARO..1921-22	3-6	385	4	Own	1-4½x5	Gas.	1
Aultman-T....	15-30	2200	4	Clim.	4-5 x6½	G,K	4
Aultman-T....	22-45	3420	4	Own	4-5½x8	G,K	6
Aultman-T....	30-60	4500	4	Own	4-7 x9	G,K,D	8-10
Automot. B-3.	12-24	1250	4	Hero.	4-4 x5½	Gas.	2-3
Avery,SR.Cul.	5-10	....	4	Own	4-3 x4	G,K	..
Avery..Cult-C	"...	....	3	Own	6-3 x4	G,K	..
Avery.....B	5-10	....	4	Own	4-3 x4	G,K	2
Avery.....C	"...	....	4	Own	6-3 x4	G,K	..
Avery.....	8-16	....	4	Own	2-5½x6	G,K,D	2-3
Avery.....	12-20	....	4	Own	4-4½x6	G,K,D	3-4
§Avery.....	....	....	*	Own	4-4x5½	G,K,D	3
Avery.....	12-25	....	4	Own	2-6½x7	G,K,D	3-4
Avery.....	14-28	....	4	Own	4-4½	G,K,D	3-4
Avery.....	18-36	....	4	Own	4-5½x6	G,K,D	4-5
Avery.....	25-50	....	4	Own	4-6½x7	G,K,D	5-6
Avery.....	45-65	....	4	Own	4-7¾x8	G,K,D	8-10
Bates Mule.H	15-25	....	4	Midw	4-4¼x5¼	Gas.	3
Bates Mule..F	18-25	....	*2	Midw	4-4¼x5¼	Gas.	3
‡Bates MuleG	25-35	....	*2	Midw	4-4½x6	Gas.	..
Beeman....G	2-4	240	4	Own	1-3½x4½	Gas.	....
Best.....	18-30	3100	*2	Own	4-4¾x6½	G,K,D	4
Best.....	60	5450	*2	Own	4-6½x8½	G,K,D	8-9
Boring...1921	.....	1850	3	Wauk	4-4⅜x5¾	GorK	2
Burn-Oil, 1922	15-30	1435	4	Own	2-6¾x7	Ker.	3-4
Capital.....	15-30	1000	2	Own	4-4¼x6	Gas.	3
Case.....	10-18	700	4	Own	4-3½x5	GorK	2
Case.....	12-20	1050	4	Own	4-4½x5	G,K,D	3
Case.....	15-27	1320	4	Own	4-4½x6	GorK	3-4
Case.....	22-40	2550	4	Own	4-5½x6¾	GorK	4-5
Case....40-72	40-72	5200	4	Own	7 x8	G,K,D	8-10
Caterpillar .5T	25	....	*2	Own	4-4¼x6	Gas.	4
Caterpillar 10T	40	....	*2	Own	4-6½x7	Gas.	6
Caterpillar T35	15-25	....	2	Own	4-4 x5½	Gas.	3
Centaur.....	5-2½	345	2	N Way	2-4½x4½	GorK	1
Chicago....40	40	2500	4	Own	4-4½x6	Gas.	4
Cletrac.....F	9-16	595	*2	Own	4-3¼x4½	G,K,D	2
Cletrac.....W	12-20	1345	*2	Own	4-4 x5½	G,K,D	2-3
Dakota.....4	15-27	1500	3	Dom.	4-4¾x6	Gas.	3
Depue.....A	20-30	2500	4	Buda	4-4½x6	Gas.	4
Dill.....D	20	2380	4	Cont.	4-4½x5½	Gas.	3
Dill.....R.W.	20	2980	4	Midw.	4-4½x6	Gas.	3
Do-It-All....A	3-6	495	..	Own	1-4½x5	Gas.	1
Eagle.....F	12-22	....	4	Own	2-7 x8	GorK	3-4
Eagle.....H	16-30	....	4	Own	2-8 x8	G or K	4-5
E-B.....AA	12-20	1095	4	Own	4-4¾x5	G,K,D	3
E-B.....Q	12-20	750	4	Own	4-4¾x5	G,K,D	3
E-B.....	16-32	1750	4	Own	4-5¼x7	G,K,D	4
Fageol.....D	9-18	1525	4	Lyc.	4-3½x5	Gas.	2
Farm Horse.B	18-30	1885	4	Clim.	4-5 x6½	G,K	4
Farquhar....	15-25	....	4	Buda	4-4½x6	G,K,D	3-4
Farquhar.....	18-35	....	4	Own	4-6 x8	G,K,D	4-5
Farquhar.....	25-50	....	4	Own	4-7 x8	G,K,D	6-7
Fitch..4 Drive	20-35	1850	4	Clim.	4-5 x6½	GorK	3-4
Fordson.....	-18	$ 395	4	Own	4-4x5	G,K	2
Fox.....E	20-40	2390	4	Own	4-5½x7½	G or K	4
Franklin....G	18-30	4000	*2	Clim.	4-5 x6½	G or K	3-4
Franklin....C	18-30	3350	*2	Clim.	4-5 x6½	G or K	3-4
Franklin...G2	18-30	4350	2	Clim.	4-5 x6½	G or K	3-4
Frick.....A	12-20	....	4	Erd.	4-4 x6	G,K	2-3
Frick.....C	15-28	....	4	Beav.	4-4¾x6	G,K	3-4
Grain Belt...A	18-36	2150	4	Wauk.	4-4¾x6¾	G or K	4
Gray.....1920	18-36	....	3	Wauk	4-4¾x6¾	Gas.	4
Gt. Western St	20-30	1950	4	Beav.	4-4¾x6	K	4
Hart-Parr...20	20	765	4	Own	2-5¼x6½	K,D.	2
Hart-Parr...30	30	895	4	Own	2-6½x7	K,D.	3
‡Hart-Parr....	....	1695	4	Own	6½x7	K.D.	..
Heider.....D	9-16	870	4	Wauk	4-4¼x5¾	G,K	2
Heider.....C	12-20	995	4	Wauk	4-4½x6¾	G,K	3
Heider....Cult	5-10	800	4	LeR.	4-3½x4½	Gas.	1
Huber Light 4.	12-25	1185	4	Wauk	4-4½x5¾	G or K	3
Huber Super 4	15-30	1885	4	Midw.	4-4½x6	Gas	3
Illinois.....C	15-30	....	4	Clim.	4-5 x6½	G,K	4
Imperial....E	40-70	4500	4	Own	4-7½x9	G,K,D	10
Indiana.....F	5-10	665	2	LeR.	4-3½x4½	Gas.	1-2
International.	8-16	†670	4	Own	4-4¼x5	G,K,D	2
Internatl.Titan	10-20	†700	4	Own	2-6½x8	G,K,D	3
International..	15-30	1750	4	Own	4-5¼x8	G,K,D	4
J-T.....N	20-40	....	*2	Clim.	4-5x6½	G,K,D	3-4
Lauson.....5	12-25	1495	4	Midw	4-4½x5½	Gas.	3
Lauson.....20	15-25	1495	4	Beav.	4-4½x6	G or K	3-4
Lauson.....21	15-30	1875	4	Beav.	4-4¾x6	G or K	3-4
‡Lauson Road	15-30	2100	4	Beav.	4-4¾x6	K	....
Leader.....B	12-18	685	4	Own	2-6 x6½	G,K,D	2-3
Leader.....N	16-32	1725	4	Clim.	4-5 x6½	G,K	3-4
‡Leader...GU	18-35	2150	*2	Clim.	4-5 x6½	G,K	3-4
Linn.....H4J	40-	4500	*	Cont.	4-4½x5½	Gas	4
Linn.....W	60	5000	*	Wauk	4-5 x6¼	Gas	6
Little Giant..B	16-22	2200	4	Own	4-4½x5	K	4
Little Giant..A	26-35	3300	4	Own	1-5½x6	K	6
Lombard.1922	85-150	8950	*2	Wisc.	6-5½x6¾	Gas.	16
Lombard.1922	50	5300	*2	Wisc.	4-4¾x6½	Gas.	6-10
Master Jr.....	5-10	585	..	LeR.	-2¾x4	Gas.	1
MerryGar1922	2	210	2	Evin	1-2½x2½	Gas.	..
Minne...All-P	12-25	800	4	Own	4-4½x7	G or K	3
Minne. Gen.P	17-30	1600	4	Own	4-4¼x7	G or K	3-4
Minne. Med.D	22-44	2650	4	Own	4-6 x7	G or K	5-6
MinneHeavyD	35-70	3850	4	Own	4-7¼x9	G or K	8-9
Mohawk .1922	8-16	650	2	Light	4-3¼x4½	K or G	1-2
Moline Univ D	9-18	....	2	Own	4-3½x5	Gas.	2-3
Moline Orch..	9-18	....	2	Own	4-3½x5	Gas.	2-3
Motor Macult.	1½	195	2	Own	1-2¾x3½	Gas.	..
NB.....1	3-6	425	4	Own	2-3¾x4	Gas.	1
Nichols-Shep.	20-42	2650	4	Own	8 x10	G or K	3-6
Nichols Shep.	25-50	3000	4	Own	9 x12	G or K	4-7
Nilson Senior..	20-40	1975	5	Wauk	4-5 x6¼	G,K	4
Oil Pull.....K	12-20	....	4	Own	2-6 x8	K,D	3
Oil Pull.....H	16-30	....	4	Own	2-7 x8½	K,D	4
Oil Pull.....G	20-40	....	4	Own	2-8 x10	K,D	5-6
Oil Pull.....E	30-60	....	4	Own	2-10x12	K,D	8-10
Oldsmar GarK	2½-5	225	4	Own	1-5½x5½	Gas.	1
Oshkosh....M	6-12	650	2	Own	2-4 x6	G,K	1
Oshkosh....G	12-24	985	2	Own	2-6 x7	G,K	3
Peoria.....L	12-25	$1600	4	Clim.	4-5 x6½	G,K	3
Pioneer....G	18-36	1750	4	Own	4-5½x6	G,K,D	4
Pioneer....C	40-75	3550	4	Own	4-7 x8	Gas.	10
Plowman....A	15-30	1295	4	Buda	4-4½x6	G,K	3-4
Reliable.....	10-20	390	4	Own	2-6 x7	Ker.	2
Rex.....	12-25	1600	4	Wauk	4-4½x5¾	G or K	3
Russell.....	12-24	1500	4	Own	4-4¼x5¾	G or K	2-3
Russell.....	15-30	2200	4	Own	4-5 x6½	G or K	3-4
Russell.....	20-35	3000	4	Own	4-5½x7	G or K	4-5
Russell.....	30-60	5000	4	Own	4-8 x10	G or K	8-10
Samson....M	....	445	4	Own	4-4 x5½	G,K	2
Sandusky,...J	10-20	1250	4	Own	4-4¼x5¼	G,K,D	2
Sandusky...E	15-35	1750	4	Own	4-5 x6½	G,K,D	4
Shelby.....D	15-30	....	4	Beav.	4-4¾x6	G,K	3
Shelby.....C	9-18	....	4	Wauk	4-3¾x5¼	G or K	2
Steady Pull..	12-24	1485	4	Own	4-4 x5	Gas.	3
Stinson....4E	18-36	1835	4	Beav.	4-4¾x6	G,K	4
Tioga.....3	18-32	....	4	Wisc.	4-4½x6	Gas.	3-4
Topp-Stewart.	30-45	....	4	Wauk	4-4¾x6¾	Gas.	3-4
Toro Cultivator	6	750	3	LeR	4-3½x4½	Gas.	2
ToroTractor'22	6-10	495	3	LeR	4-3½x4½	Gas.	2
Townsend....	10-20	800	2	Own	4-6½x7	Ker.	2-3
Townsend....	15-30	1350	2	Own	4-7 x8	Ker.	3-4
Townsend....	25-50	2500	2	Own	4-8½x10	Ker.	4-8
Traction Motor	40-50	....	4	....	8-3¼x5	Gas.	4-5
Traylor....TB	6-12	500	4	LeR.	4-3½x4½	Gas.	1-2
Trundaar....10	25-40	3750	*2	Wauk	4-5 x6¼	G or K	4
Twin City....	12-20	1200	4	Own	4-4¼x6	G,K	3
Twin City....	20-35	2750	4	Own	4-5½x6¾	G,K	5-6
Twin City....	40-65	4750	4	Own	4-7¾x9	G,K	8-10
Uncle Sam C20	12-20	1295	4	Weid.	4-4 x5½	G	2-3
Uncle Sam B19	20-30	1985	4	Beav.	4-4¾x6	G or K	3-4
Uncle Sam D21	20-30	1895	4	Beav.	4-4¾x6	G or K	3-4
Utilitor....501	2¼-4	295	4	Own	1-3½x4½	G	1
Utilitor...501A	2¼-4	340	4	Own	1-3½x4½	G	1
Vim.....B	15-30	1190	4	Wauk	4-4¾x5¾	G,K	3
Wallis.....K	15-25	†995	4	Own	4-4¼x5¾	G,K	3
Waterloo....N	12-25	675	4	Own	2-6½x7	Ker.	3
Wetmore21-22	12-25	1185	4	Wauk	4-4 x5¾	G,K	3
Whitney....D	9-18	595	4	Own	2-5½x6½	Gas.	2
Wichita.....T	15-30	2000	4	Beav.	4-4½x6	G,K,D	3-4
Wisconsin...E	16-30	1850	4	Clim.	4-5 x6½	G or K	3
Wisconsin...F	20-40	2050	4	Wauk	4-5 x6¼	G or K	4
Wisconsin,..H	22-40	2550	4	Clim.	4-5½x7	G or K	4-6
Yuba....12-20	12-20	2400	*2	Wisc.	4-4½x6¾	G,K,D	3
Yuba....15-25	15-25	2750	*2	Wisc.	4-4¼x6	G,K,D	..
Yuba....20-35	20-35	3900	*2	Wisc.	4-5¾x7	G,K,D	4
Yuba....25-40	25-40	4250	*2	Wisc.	4-5¾x7	G,K,D	..
‡Yuba.....	25-40	4750	*2	Yuba	4-5¼x7	D	..
Zelle.....	12-25	....	4	Buda	4-4¼x5½	G or K	3

ABBREVIATIONS: G—Gasoline. K—Kerosene. D—Distillate. Plow capacity varies in relation to operating conditions. Figures are based on 14 in. plows. Engine Make: Beav.—Beaver. Clim.—Climax. Cont.—Continental. Dom.—Domas. Evin.—Evinrude. Herc.—Hercules. LeR.—LeRoy. Midw.—Midwest. Nway.—New Way. Nor.—Northway. T.C.—Twin City. Wauk.—Waukesha. Weid.—Weidely. Wis.—Wisconsin. *—Crawler type. All others are wheel type. †Price includes plows. §Track Runner. ‡Industrial Tractor.